Chemical Age

ANNUAL REVIEW AND 1960 PREVIEW NUMBER

VOL. 83 No. 2113

9 January 1960

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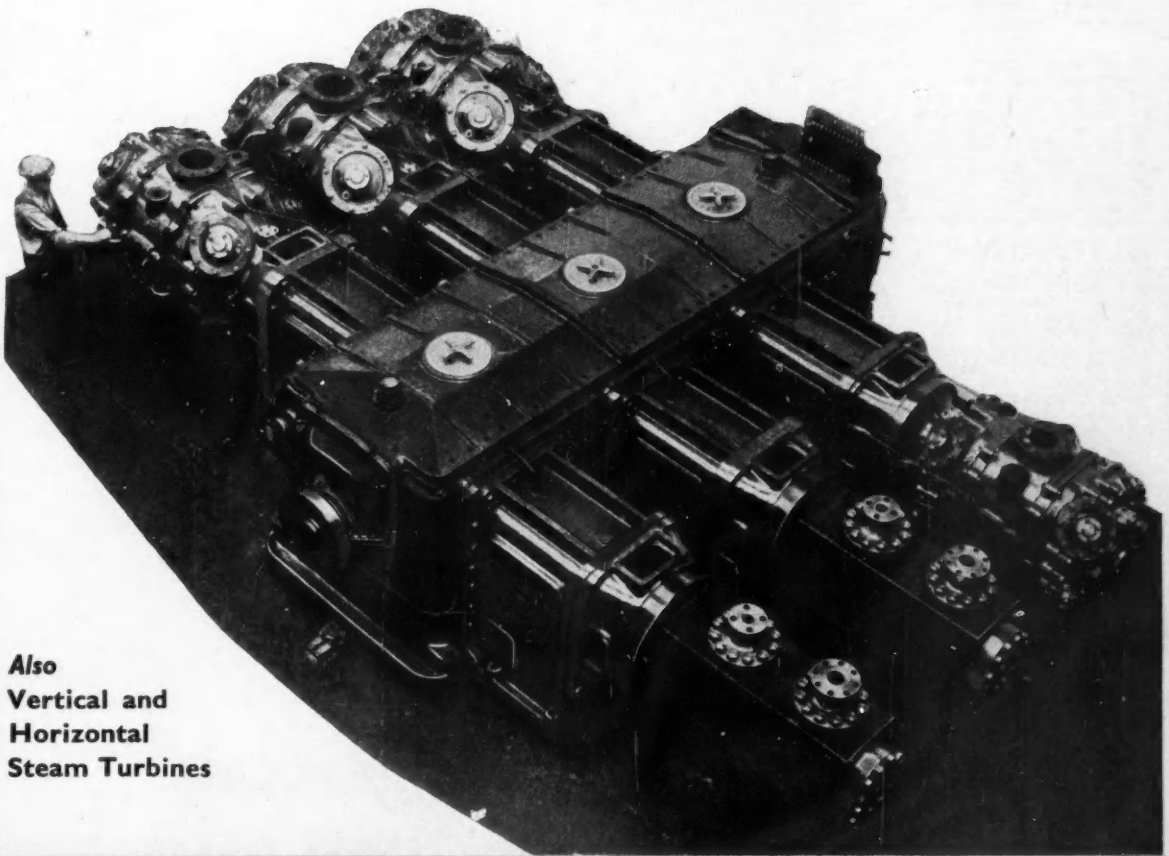

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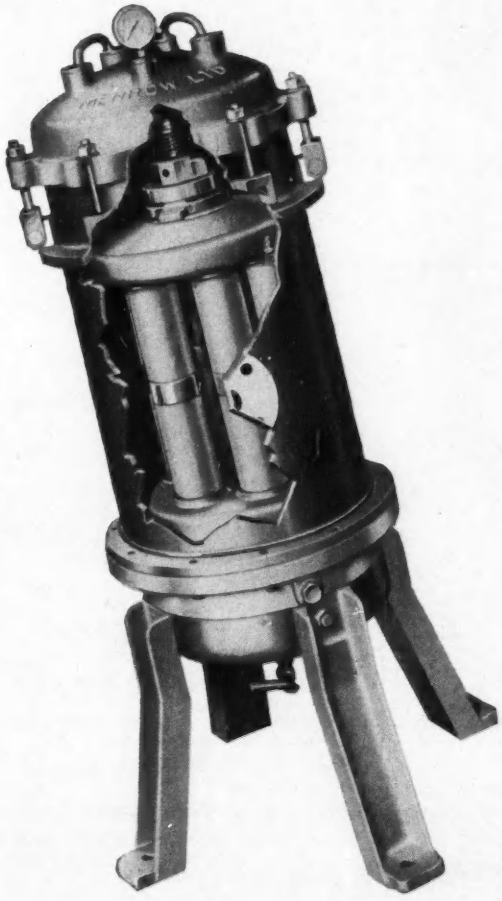

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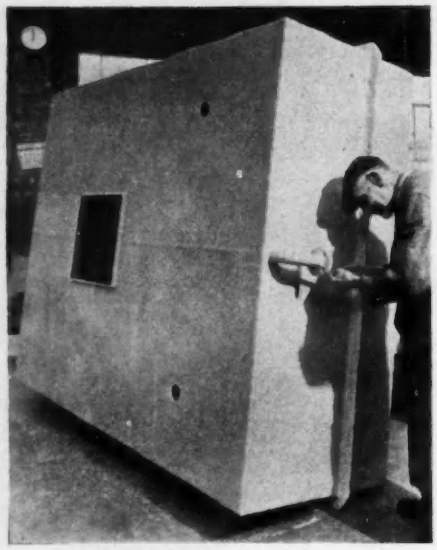

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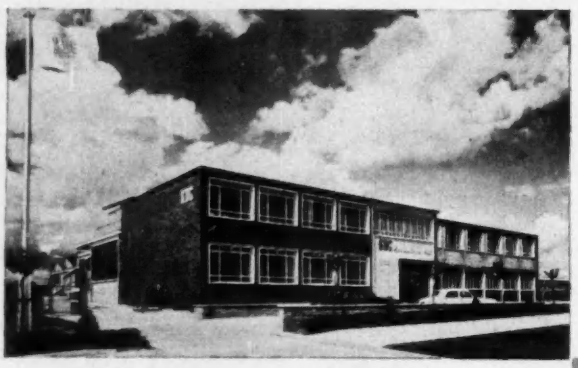

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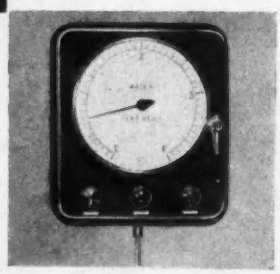

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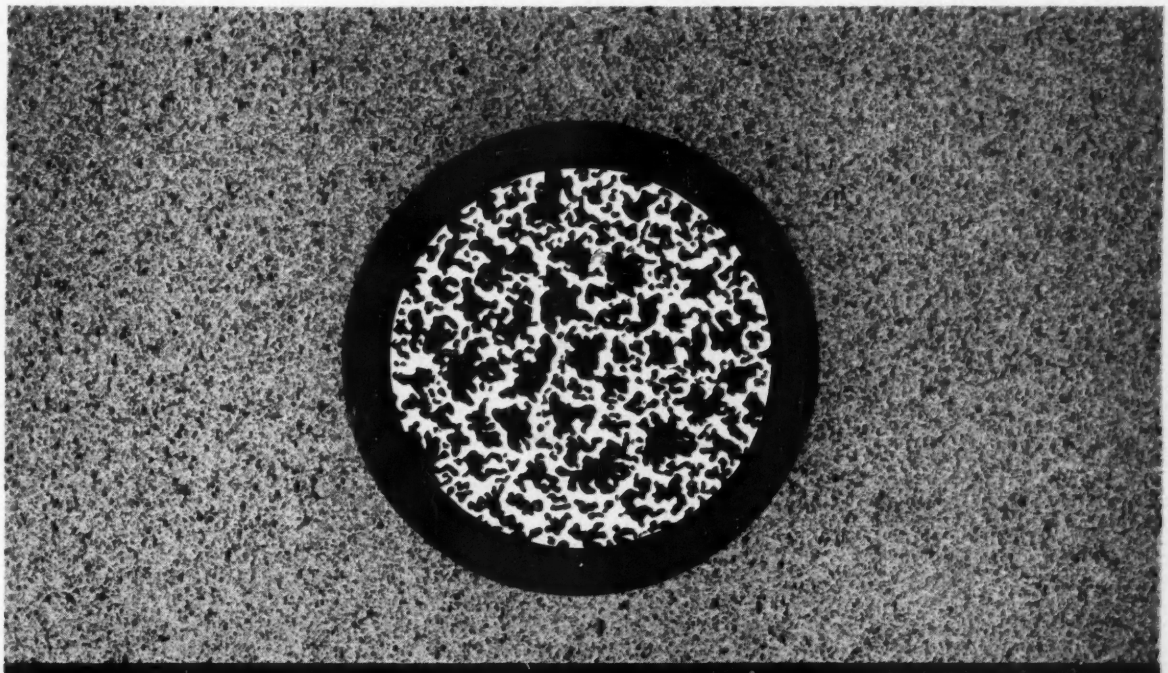

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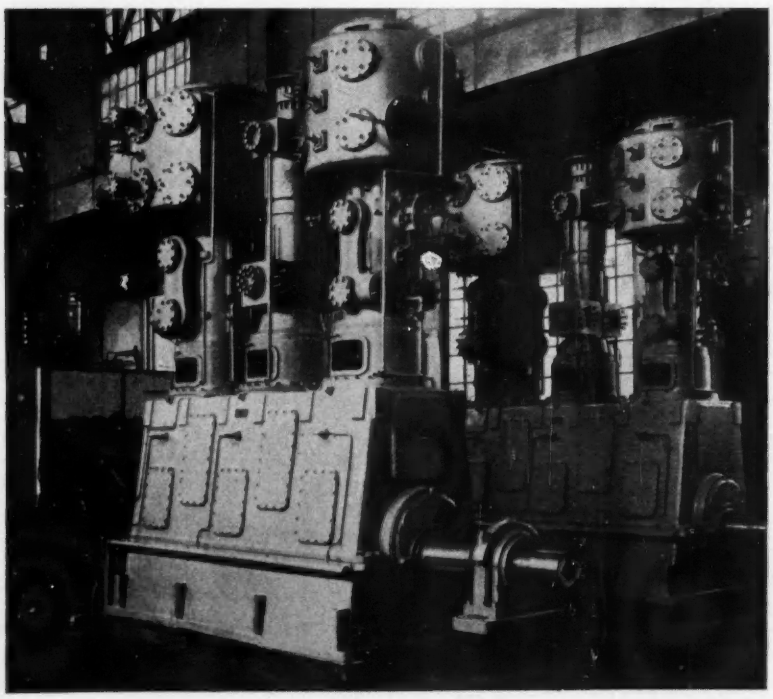

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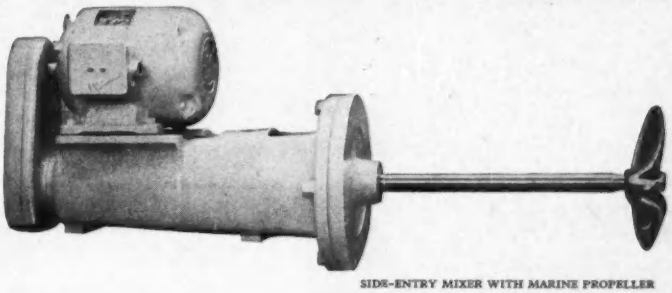

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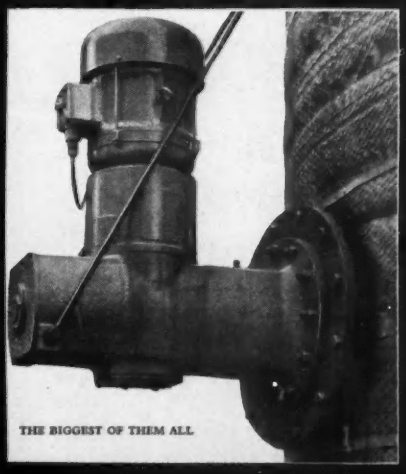

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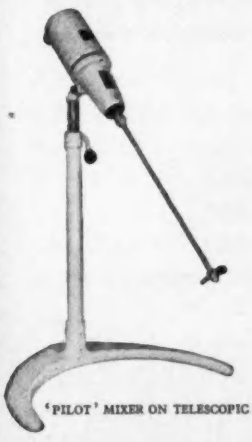

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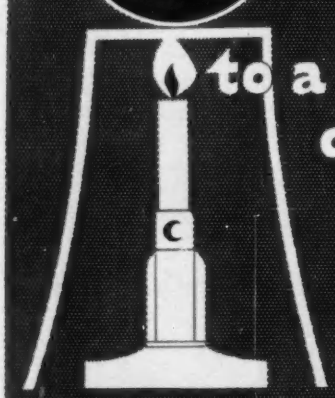

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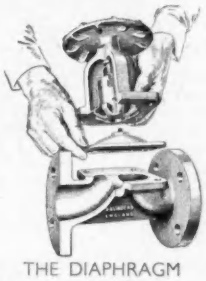

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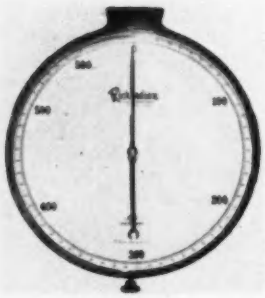

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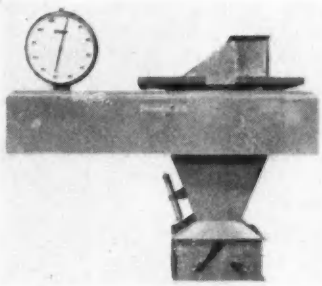

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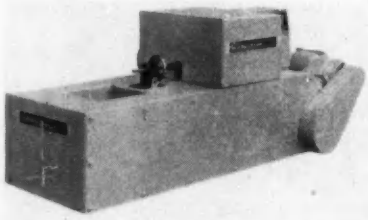

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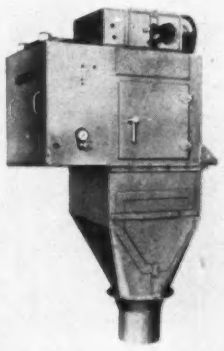

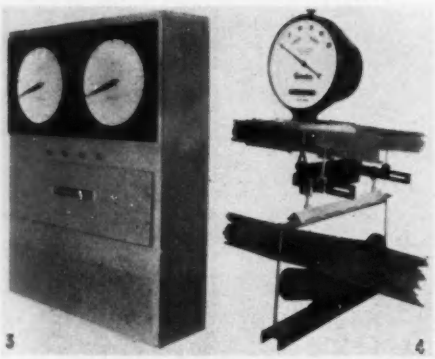

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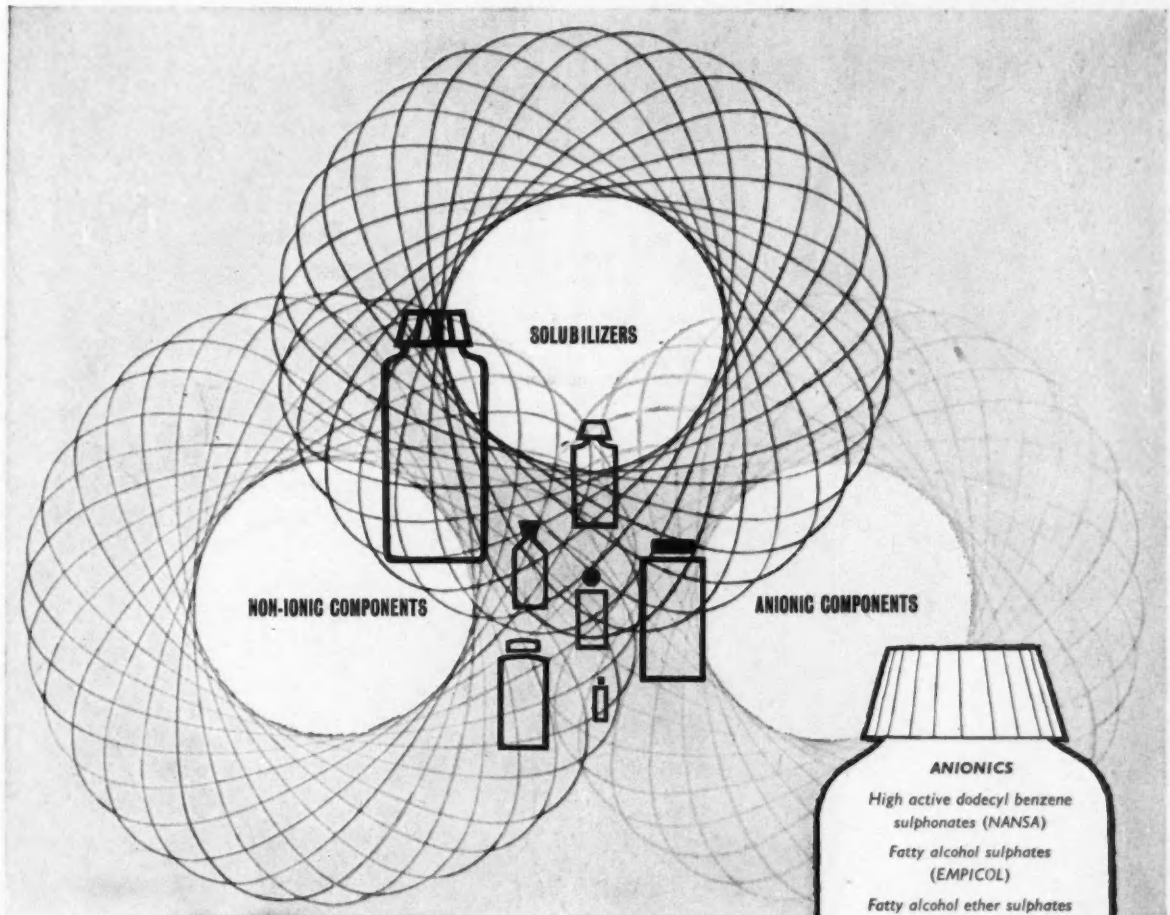

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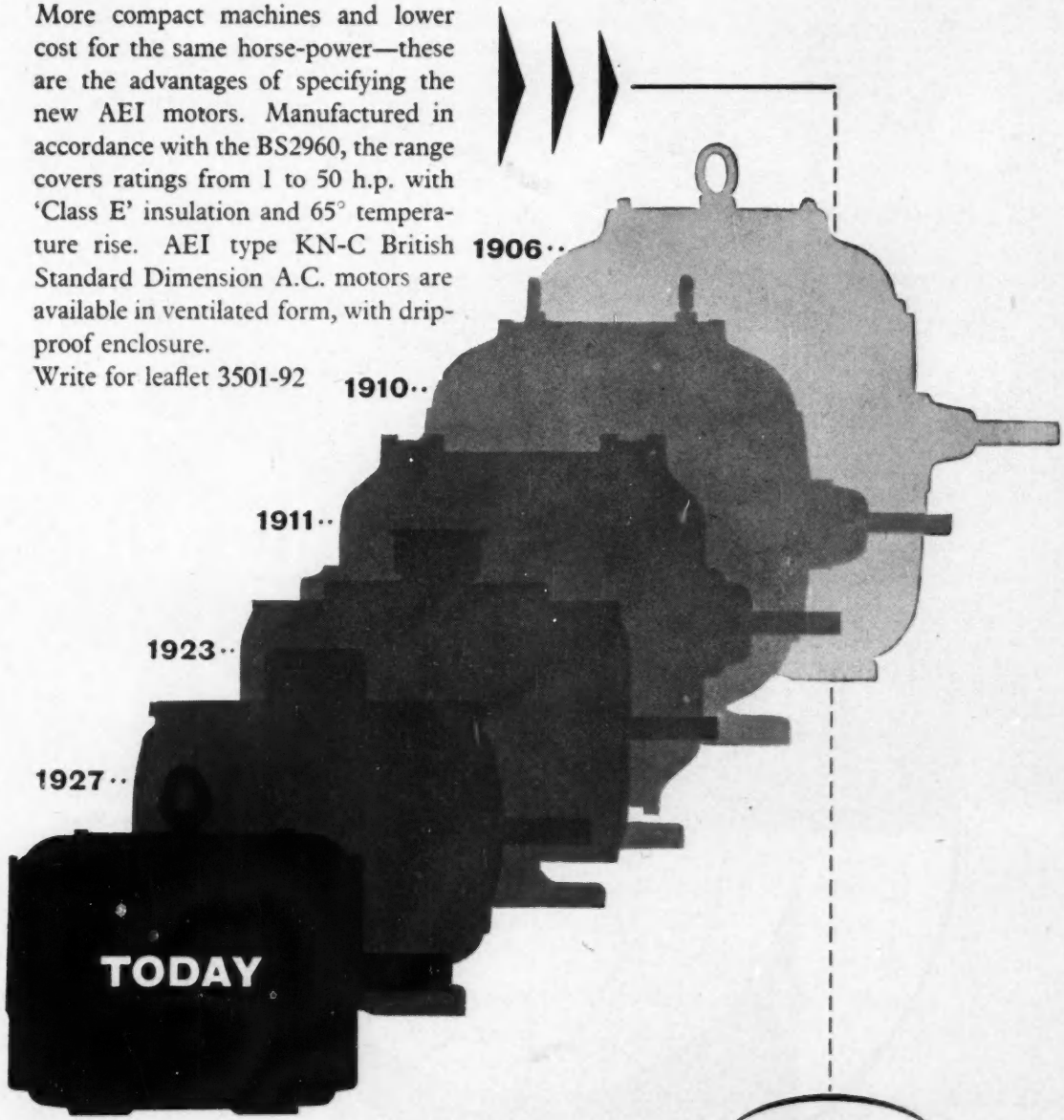

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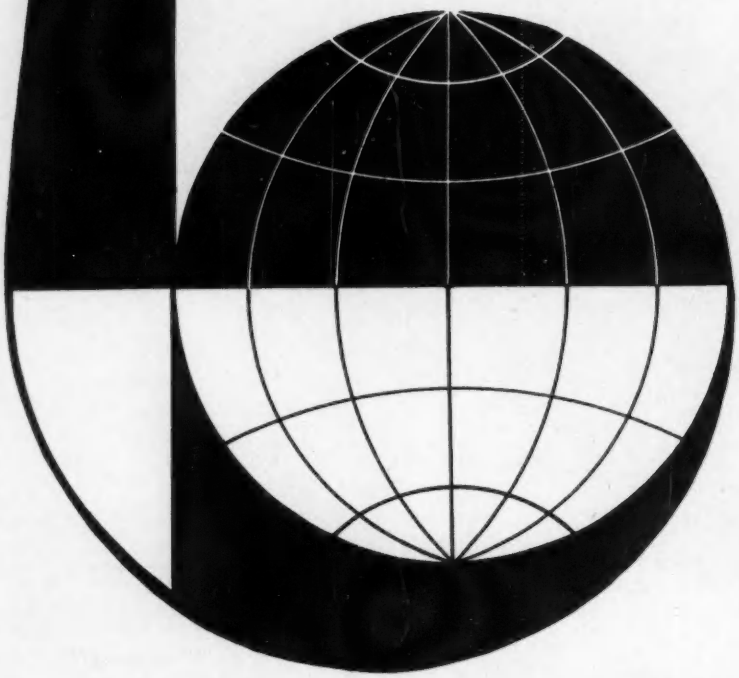

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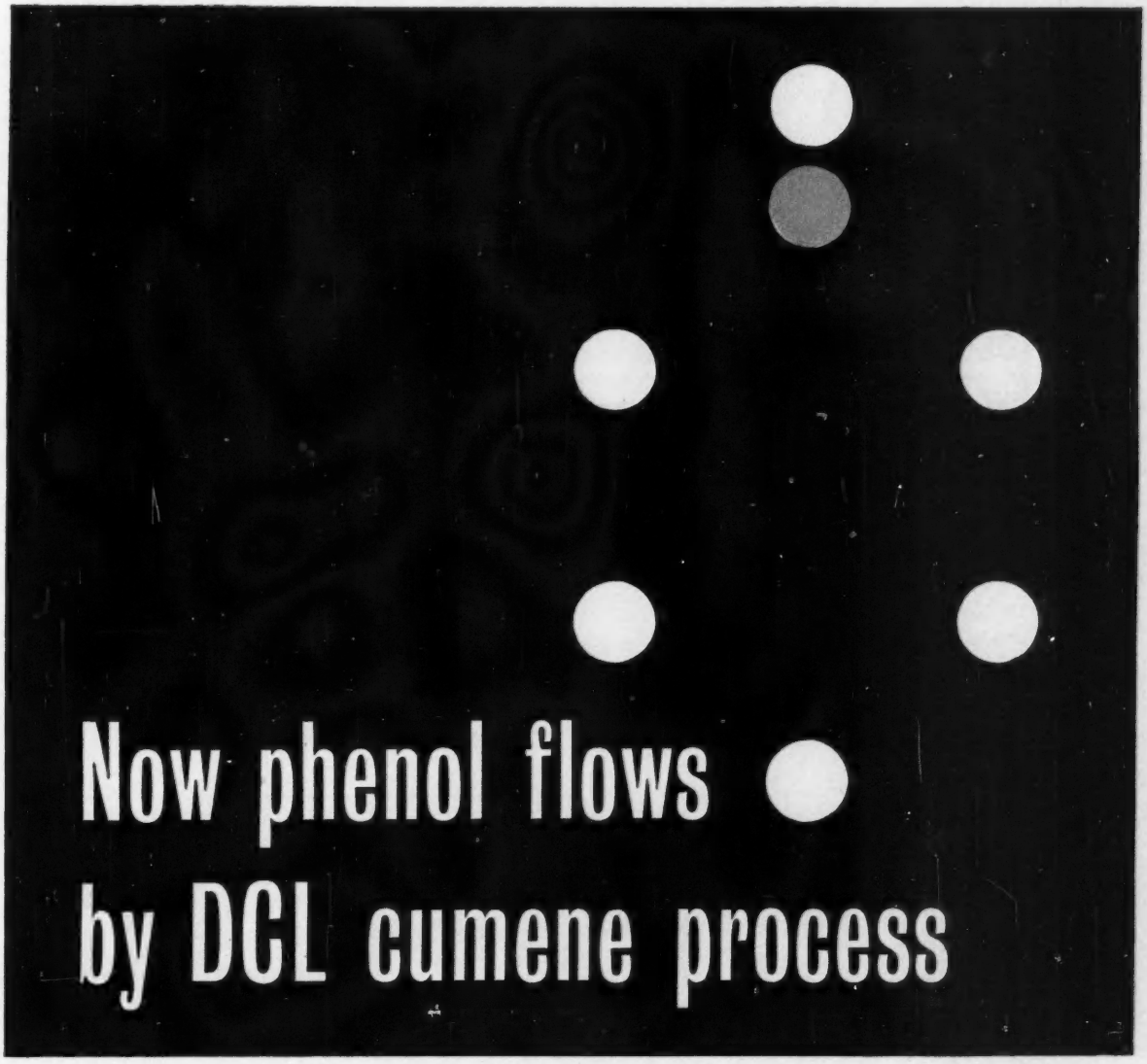

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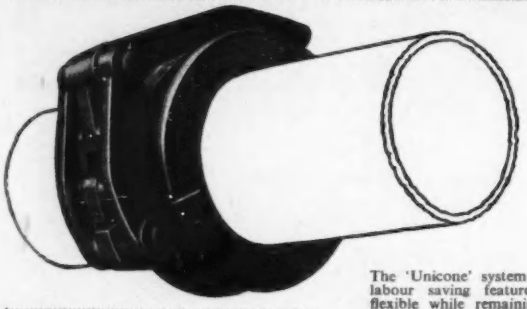

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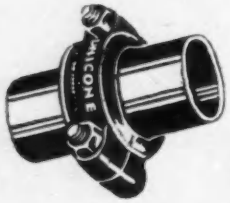

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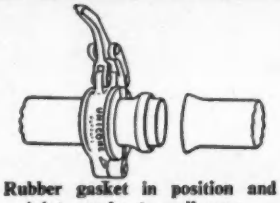
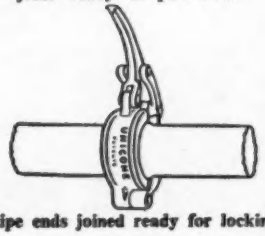
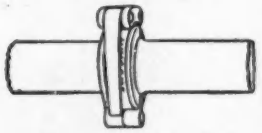


Rubber gasket in position and joint ready to pull over.



Pipe ends joined ready for locking.



The completed joint.

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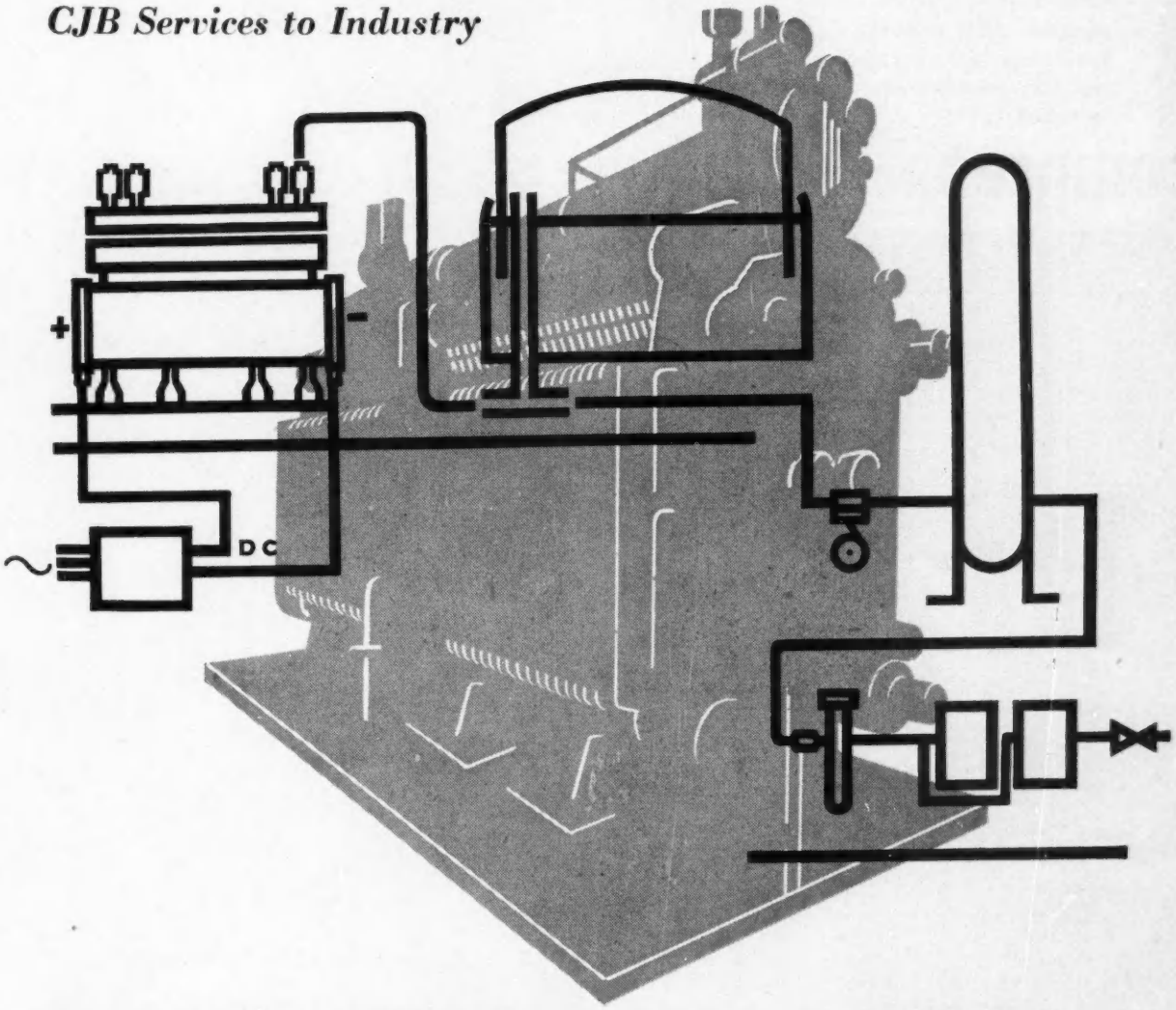

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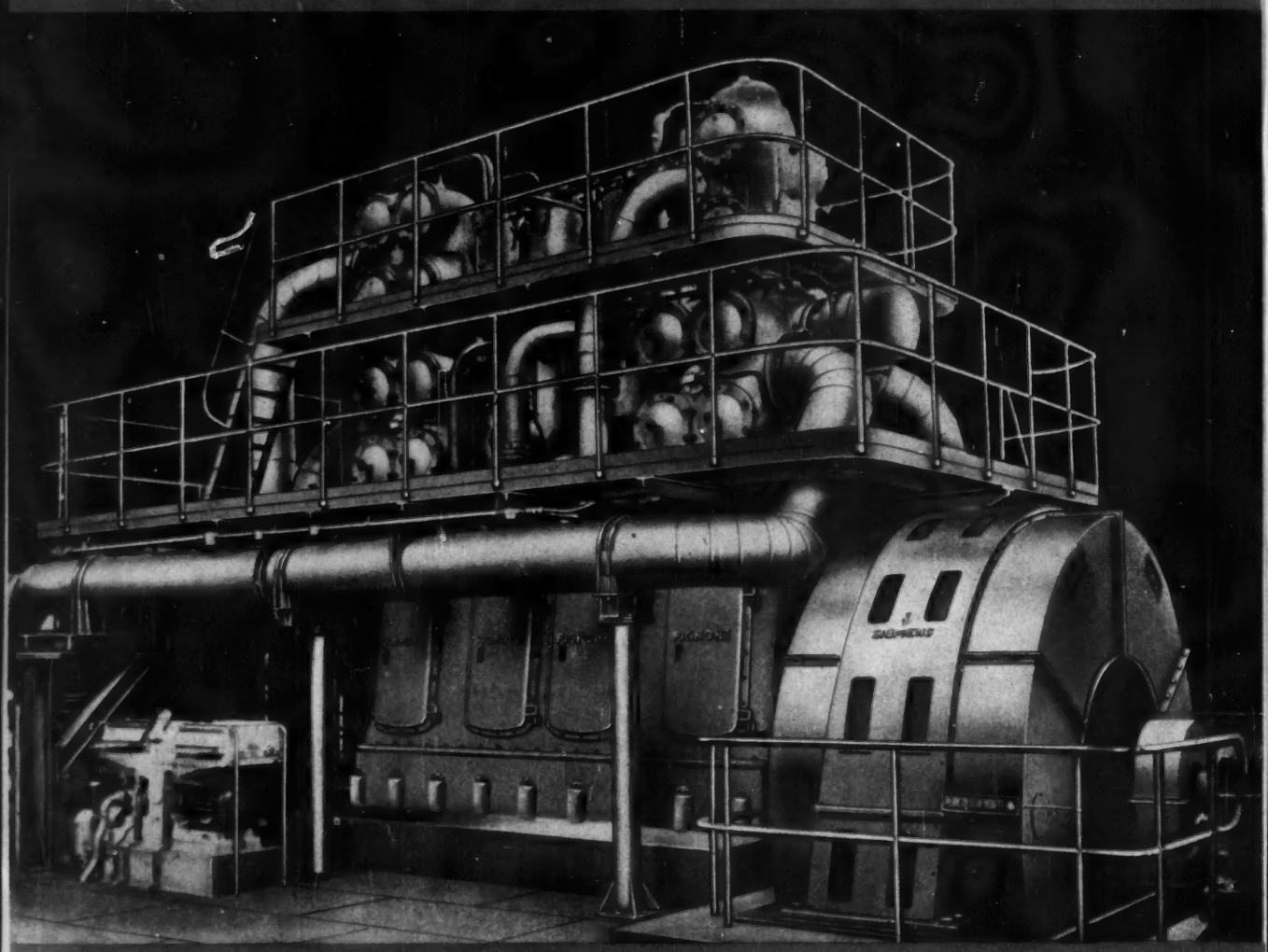

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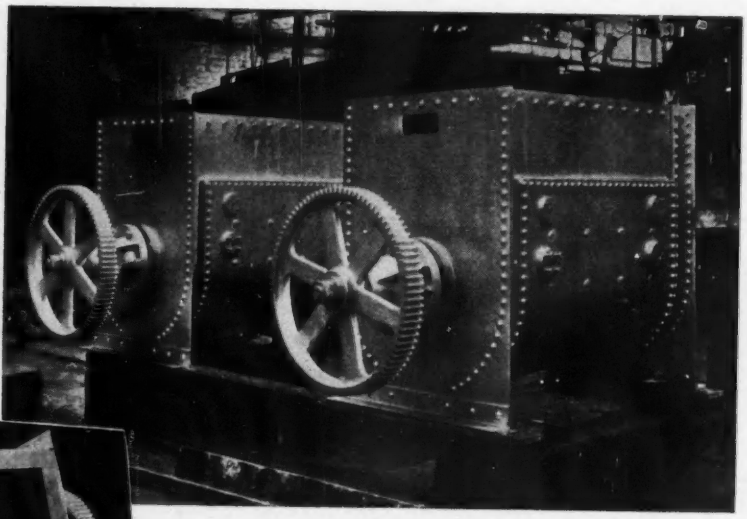

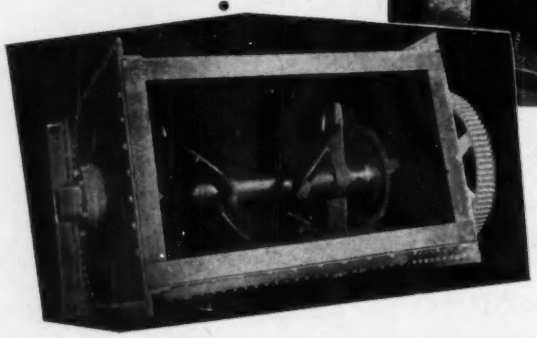

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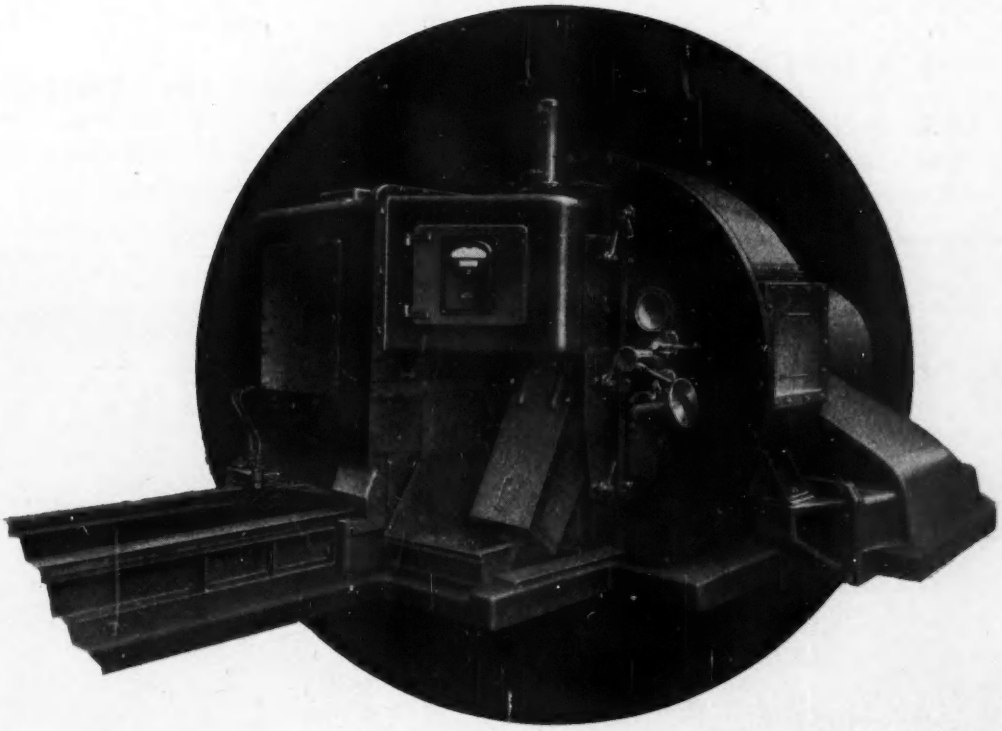

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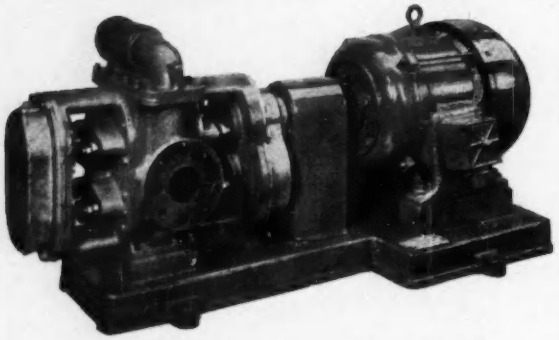

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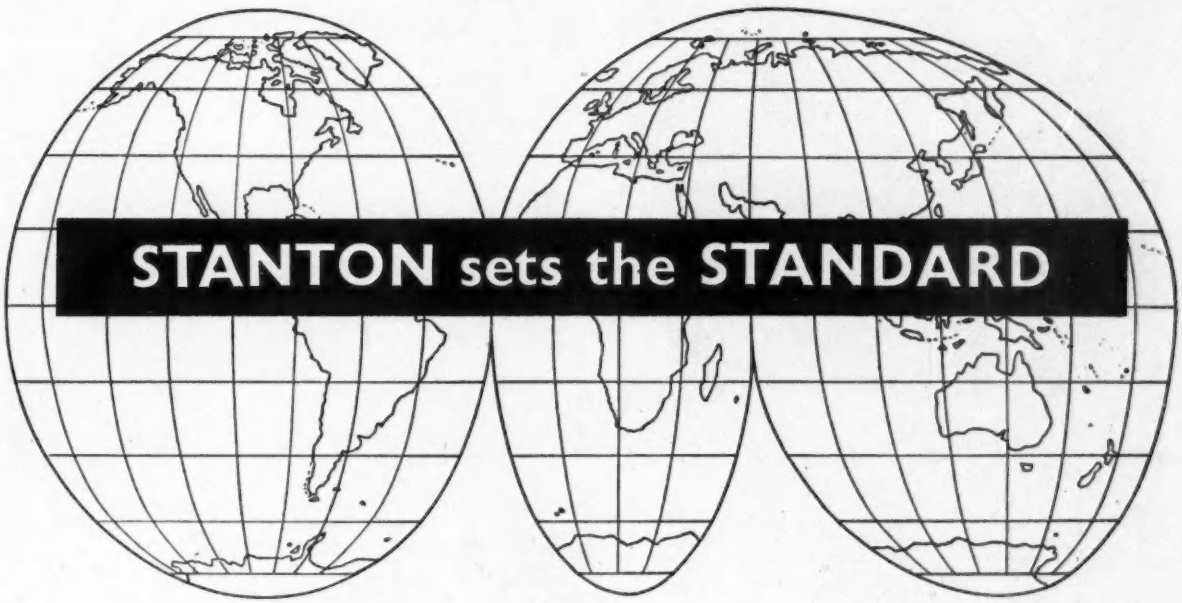

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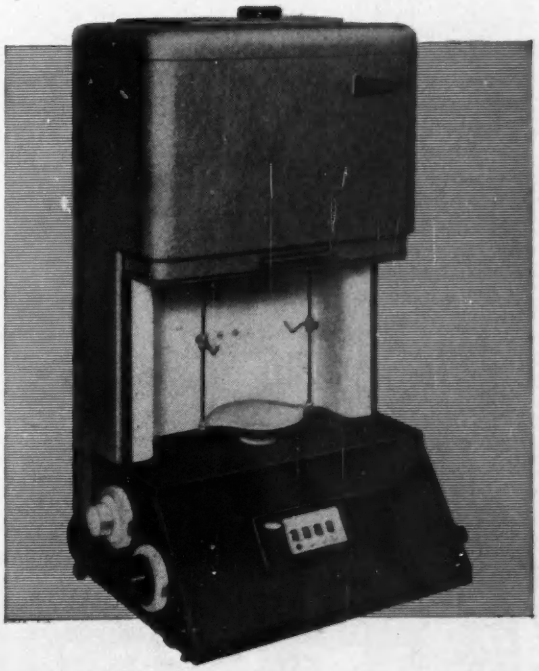

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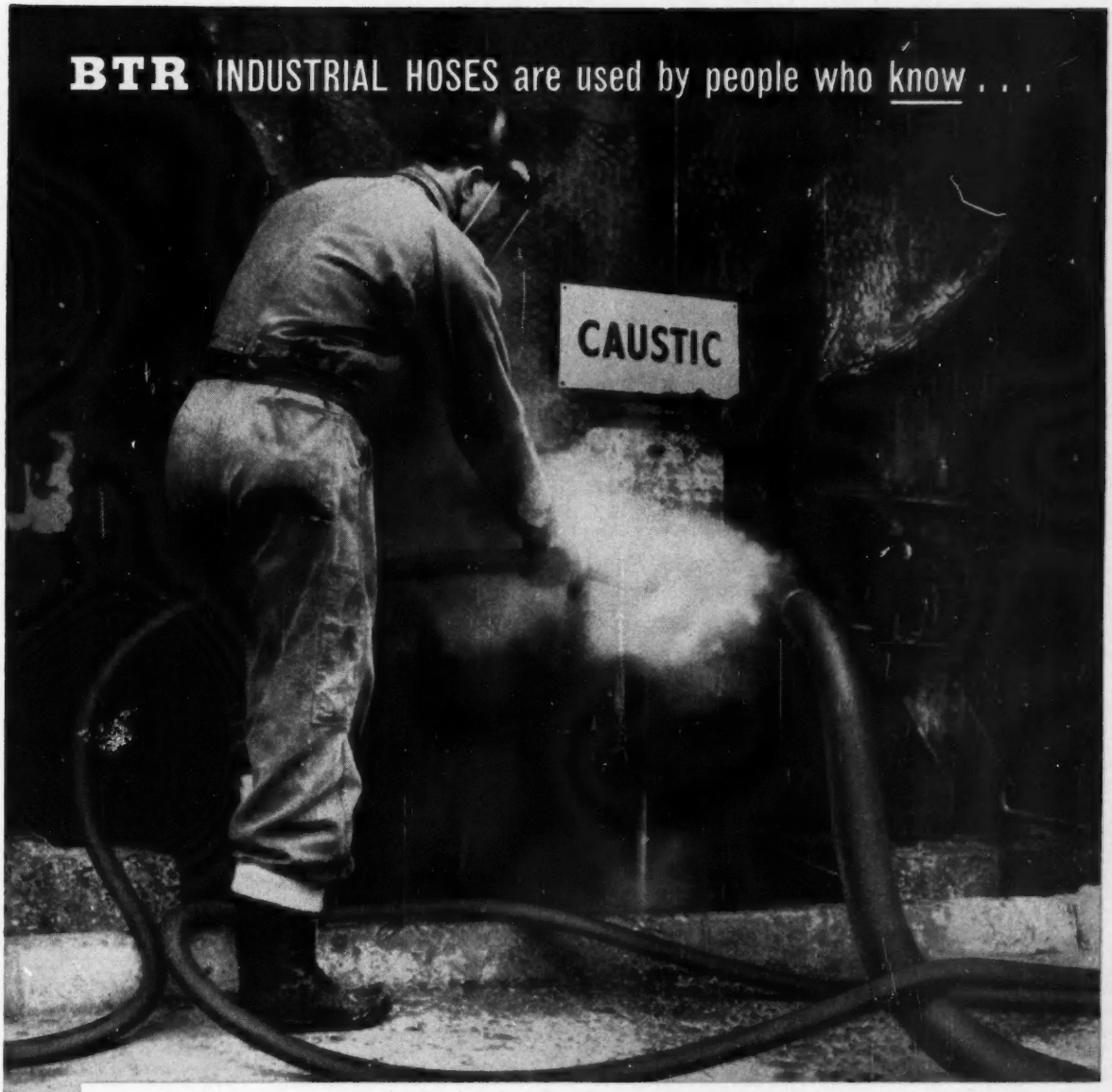

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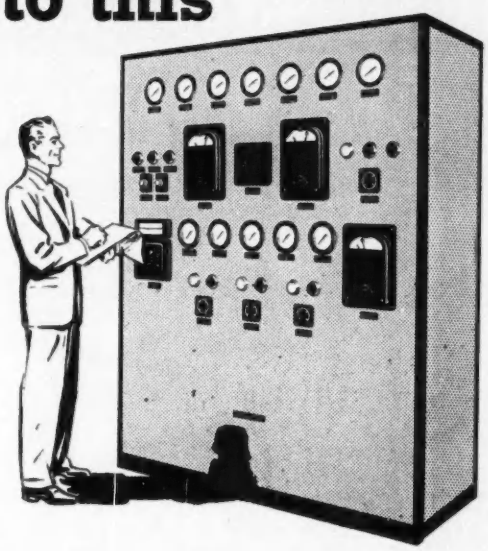

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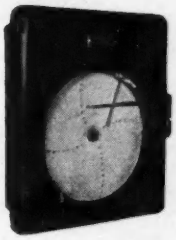

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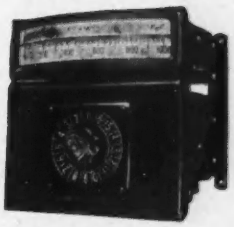

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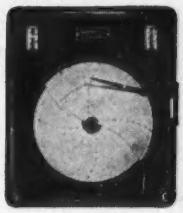

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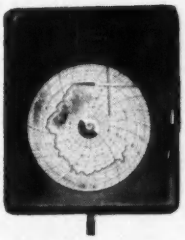

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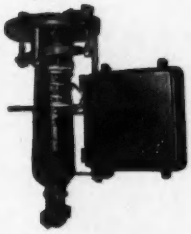

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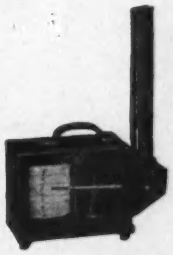

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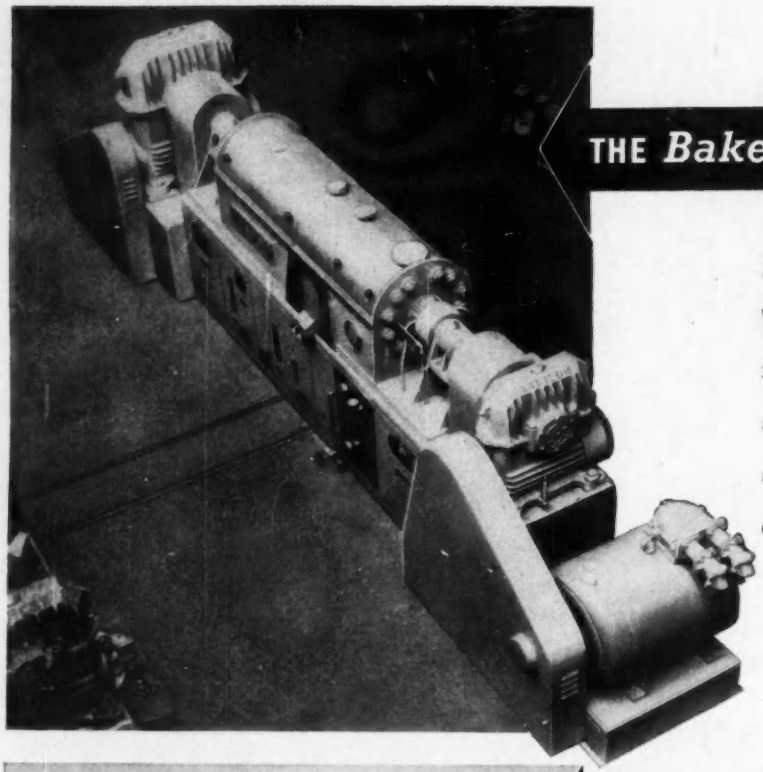

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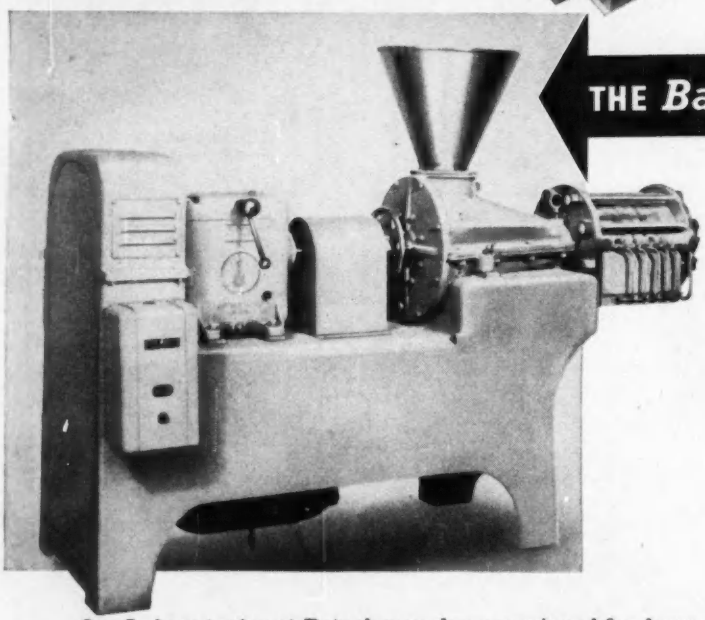

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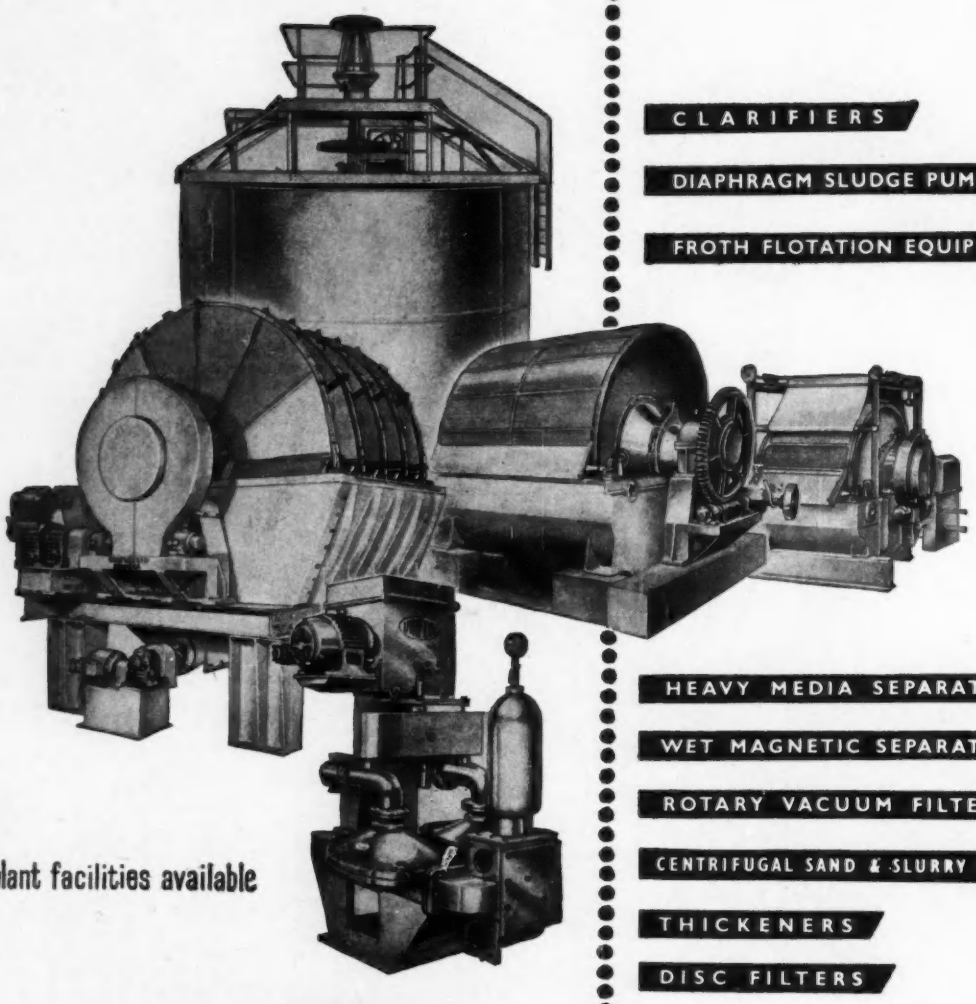

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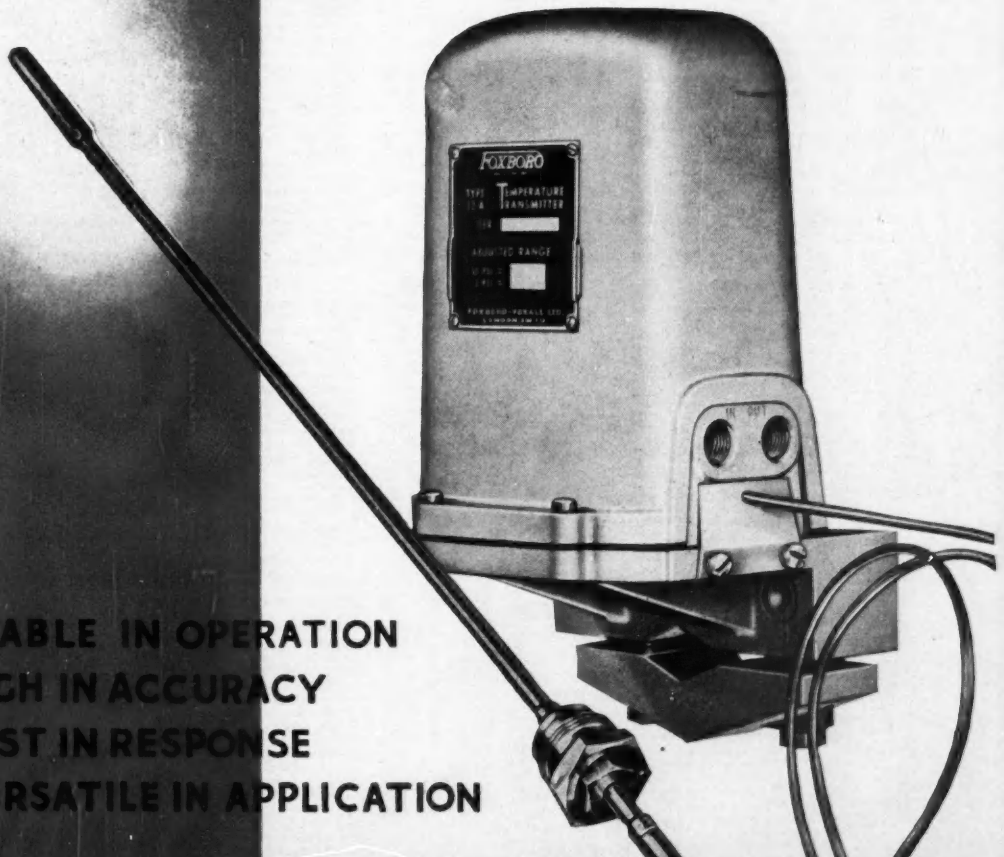

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Butene-2-diol-1:4
Chalcone and Derivatives
6-Chloro-hexanol-1
Choline base & compounds
Colchicine
Colchicoside
Cyclodecanol
*Cyclodecanone
Cyclodecane
Cyclodecyl halides
Cyclodecylamine
Cyclodecyl urea
Cyclododecanol
Cyclododecanone
Cyclododecane
Cyclododecyl bromide & chloride
Cyclododecylamine
Cyclododecyl urea
*Cycloheptyl urea
Cyclohexyl urea
Cycloheptane
Cycloheptanol
Cycloheptanone
Cycloheptyl bromide & chloride
Cycloheptylamine
*Cyclononane
Cyclononanol
*Cyclononanone
Cyclononyl halides
Cyclononylamine
Cyclononyl urea
Cyclooctane
Cyclooctanol
Cyclooctanone
Cyclooctyl halogenides
Cyclooctylamine
Cyclooctyl urea
Cyclopentanol
Cyclopentanone
Cyclopentylamine
Cyclopentyl bromide & chloride
Cyclopentyl urea
*Cycloundecane
*Cycloundecanol
*Cycloundecanone
Decahydroquinoline (cis & trans)
Decamethylene dinitrile
Decanediol-1:10
1, 5-Diaminopentane
1, 7-Diaminoheptane
1, 8-Diaminooctane
1, 9-Diaminononane
1, 10-Diaminodecane
1, 11-Diaminoundecane
1, 12-Diaminododecane
1, 13-Diaminotridecane
1, 5-Dibromopentane
1, 6-Dibromohexane
*1, 7-Dibromoheptane
1, 8-Dibromooctane
1, 9-Dibrononane
1, 10-Dibromodecane
1, 11-Dibromoundecane
1, 4-Dibromobutene-2
*1, 7 (2:8) Dibromooctane
2, 5-Dibromo-hexene-3
2, 5-Dibromohexane
1, 6-Dichlorohexane
*1, 7-Dichloroheptane
1, 8-Dichlorooctane
1, 9-Dichlorononane
1, 10-Dichlorodecane
1, 4-Dichlorobutene-2
2, 5-Dichloro-hexane-3
2, 5-Dichlorohexane
2, 3-Dichloro-1, 4-naphthoquinone
Dicycloheptylamine
1, 4-Dicyclohexanolyl diacetylene
Dicyclooctylamine
Dicyclopentadienyliron
Dicyclopentylamine
Dicyclohexanolylbutane

*Dihydromucodinitrile
*Dihydrofuran
1, 8-Diiodooctane
Dimercaptopropanol redistilled
1, 8-Dimethoxyoctane
1, 8-Dimethoxyoctadien-1, 7-diyne-3, 5
Dimethyl brassylate
2, 5-Dimethyltetrahydrofuran
Dimethyl thapsate
*N'N-Dimethylaminoglycerol
*2, 5-Dimethylpyrroline
Dimethyl dodecamethylene dicarboxylate
3, 8-Dimethyloctanediol-2, 7
2, 7-Dimethyloctadiyne-3, 5-diol-2, 7
3, 8-Dimethyldecanediol-3, 8
3, 8-Dimethyldecadiyne-4, 6-diol-3, 8
2, 5-Dimethyl pyrrole
1, 6-Dimorpholinyl-hexadiyne-2, 4
Di-n-decylamine
Dodecandioic acid dimethylate
bis gama Phenylpropylethylamine base
*Heptanediol-1, 7
Heptamethylene dinitrile
n-Heptadecyl alcohol
n-Heptadecanoic acid nitrile
Heneicosylic acid
Heptadecylic acid
Hexanediol-1, 6
Heneicosylic alcohol
Hexanediol-2, 5
n-Heneicosanoic acid nitrile
Hexadecanediol-1, 16
Hexamethylene dinitrile
Hexahydro-p-xylyldiamine
*Hexadiyne-2, 4-diol-1, 6
beta-Hydroxyethylmorpholine
Hexene-3-diol-2, 5
Ibogain
Isobutylene stabilized
Lauryl chloride (96%)
Lauryl iodide
Margaronitrile
beta-Mercaptoethylamine HCl;
5-Methoxy-1-chloropentene-2
1-Methoxybuten-1-in-3
5-Methoxy-3-chloropentene-1
3-Methylheptanediol-2, 4
3-Methyl-5-ethylheptanediol-2, 4
3-Methylpentanediol-2, 4
3-Methyl-5-ethylnonanediol-2, 4
2-Methyltetrahydrofuran
1-Methyl-1, 2, 3, 4-tetrahydroquinoline
4-Methyltetrahydropyran
2-Methyl-1, 2, 3, 4-tetrahydroisoquinoline
n-Nonadecylic alcohol
Nonadecylic acid
Nonamethylene dinitrile
n-Nonadecanoic acid nitrile
Nonanediol-1, 9
Octamethylene dinitrile
*Octanediol-1, 8
n-Pentadecyl alcohol
Pentadecylic acid
Pentadecandioic acid dimethylate
Pentamethylene dinitrile
n-Pentadecanoic acid nitrile
*Pentadecanediol-1, 15
*Pimelic acid
Pivalic acid
*Pyrroline
trans-Stilbene
Suberic acid
Serotonin creatinine sulphate
Tetradecandioic acid dimethylate
1, 2, 3, 4-Tetrahydroisoquinoline
1, 2, 3, 4-Tetrahydroquinoline
Tetrahydropyran
*Tetradecanediol-1, 14
Tridecylic acid
*Thapsic acid
*Tridecylic alcohol
n-Tridecanoic acid nitrile
Triacosylic acid
n-Triacosylic alcohol
n-Triacosanoic acid nitrile
Tridecandioic acid dimethylate
Tri-n-octylamine
Undecanediol-1, 11
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Undecandioic acid dimethylate
Undecamethylene dinitrile

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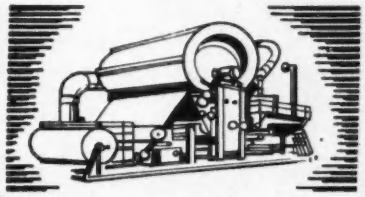

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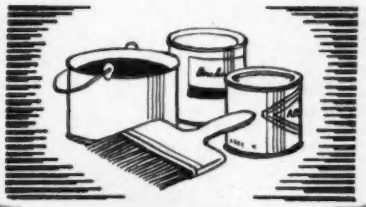

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CHEMICAL AGE

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TO THE 1960's

CHEMICAL industry in the 50's has seen many changes, and the consensus of opinion is that the last decade has been the mightiest yet for chemicals, both with regard to new discoveries and technological developments. The new decade now beginning can be expected to be quite as interesting and exciting as the last as far as the chemical industry is concerned, so that by the time 1970 is reached it will appear that a revolution in many paths of scientific progress has taken place.

Although marked by disturbed periods, British chemical industry has grown in strength and stature. Last year, for instance, saw the 'maturity' of Britain's petrochemical developments, so that now Britain ranks as the second largest producer of petrochemicals after the U.S.—a fine achievement.

A particularly strong growth section of the industry is that of plastics and allied products. The boom in plastics and synthetic rubbers is tied in with the present economic pattern, and can be linked particularly with the notable advance in Britain's car industry. Last year was a particularly successful one for plastics. Exports rose markedly in nearly every instance, and the total for the 10 months to 31 October 1959 (U.K. Trade and Navigation Accounts) shows that £32,542,698 worth of plastics was exported compared with £25,632,755. There is no sign of any setback foreseen for 1960 and indeed, gains in this section should continue. Leading the field are polythene (high-pressure), polyesters, vinyls, with the epoxies and silicones showing good gains. This year is expected to see the first British commercial-scale polypropylene plant on stream—that of I.C.I. at Wilton. It is expected that commercial production of polycarbonates, now being produced in Germany and the U.S. will be advanced in the U.K.

Fertiliser producers in this country are undoubtedly optimistic about 1960 and the first half of the 60's. The coming year can be expected to be as good as 1959 and will more than likely be better. Already diminished stocks of nitrogen compounds are causing concern, particularly in the U.S., and nitrogen prices which were reduced in 1959 are now showing an upward trend. Exports of U.K. manufactured fertilisers in the first ten months of 1959 were down by almost £2 million to £4,667,328, while imports rose from £7,949,753 to £8,025,253. The reason for this increase is said to be that Shell Chemical's nitrogen plant at Shell Haven was delayed coming into operation and fertiliser demand proved heavy. The decrease in value of U.K. fertiliser exports is undoubtedly due to the marked reduction in fertiliser prices during 1959.

A bright spot in the industry is in pharmaceutical chemicals. Our survey (p. 65) shows a percentage increase of 13.0 in sales in this section. Exports of drugs, medicines and medicinal preparations in the first ten months of 1959 rose in value from £31,286,889 to £33,031,198. Drug imports, i.e. for vitamins, antibiotics, alkaloids, proprietary medicines, show a marked decrease from £7,945,460 to £2,834,669 over 10 months periods for 1958 and 1959 respectively.

Research expenditure in both the fine chemicals and pharmaceuticals sections is indicated as larger than in most others and as will be noted from

the C.A. survey, new products have been responsible for increased sales. As was indicated in the recent N.R.D.C. report (CHEMICAL AGE, 26 December 1959, p. 929) new antibiotics based on cephalosporin will be produced. Work has continued on 'live' polio vaccines and it is expected that some interesting announcements will be made in the coming year. Other drugs about which more will be heard will be oral contraceptives and geriatric-type preparations.

After the fine chemicals and pharmaceutical sectors, pesticides and coal tar products show substantial increases. In the case of coal tar products this upward trend was indicated in our survey in January 1959. Greatest growth may be expected, especially in the next six months, in phenols and benzole.

In the pesticide group, it is expected that new products will be announced which will be of world interest. It is known that a new selective weedkiller which can be used with cereal crops and which is effective when used in very small dosages, will be introduced, as will a new general-all-purpose insecticide of an interesting chemical composition. New plant hormones can also be expected.

Dyestuffs, which have been in the doldrums for so long, are now making a comeback due, it is assumed, to the development of new types of dyes. The doubtful factor here seems to be the effect of the new tariffs. Dyestuffs are among the few other British industrial products still protected by import restrictions. But between now and 1 July the Dyestuffs Act, under which imports are banned except under licence, will be repealed by Parliament and replaced by a 33⅓% tariff which will then be progressively reduced before being totally eliminated in 1970.

Sulphuric acid production in 1959 was up 5.3% and consumption rose 5.2%. Prices for sulphur are still tending to fall due to competition between U.S. and Mexican products, while this year will see more Lacq sulphur on the market. Production of this acid, based on upward trend in fertilisers alone can be expected to increase in 1960. Of the other acids, hydrofluoric acid production can also be expected to rise on greater demand for chlorinated hydrocarbons, elemental flourine and fluorides. Sales of heavy chemicals generally have made notable gains.

Oxygen, judged by the tonnage oxygen plants that are being installed, together with the other industrial gases—carbon dioxide, hydrogen and nitrogen—are all believed to have been in good demand in 1959.

The newer metals such as titanium, tantalum, zirconium and beryllium are now finding suitable markets after a rather shaky start; this applies most particularly to titanium. Last year, too, saw the coming into commercial production of Europe's first beryllium plant—that of I.C.I. at Witton. It is expected, too, that interesting results will be published shortly of the experiments into minute super-strong metal crystals free from all flaws, or dislocations, as well as news of high-temperature resistant alloys.

Last year saw new records set for the chemical export trade. Thus while chemical exports in 1958 totalled £21.8 million per month (a percentage change of −2 on the previous year) in the period January to August 1959 they totalled £23.9 million per month (an increase of 10%) and in September-November 1959 they totalled £25.1 million per month (+14%). Chemical imports, however, have increased, for while in 1958 they were an average of £10 million a month (+5%), in the period January to August, 1959, they averaged £10.8 million a month (+9%) and in September-November last totalled £12.6 million (+27%).

It is interesting to note that the C.A. survey indicates that those companies of the chemical industry spending more than the average of about 4% on research have all had increased sales. Expenditure on new plant or new extensions has also helped to boost production, cut costs and hence increase sales. It is to be hoped that research and development expenditure, while this should not be out of proportion to good business economics, should not be as neglected as it has been in some sections of the industry during the last decade. It is worth noting that Sir Miles Thomas, when asked recently to give his views on the scientific and technological outlook for 1960, considered that during 1960 and the next few years more and louder demands would be heard that the industry should undertake vast expenditures in new fields of research and development. Sir Miles hoped, however, that while "our mental resources are unbounded, our finances are not. High-quality research in a limited number of carefully chosen fields is worth a great deal more than a host of ill-conceived, half-baked projects undertaken simply because of national prestige." This view was also expressed by Professors Carter and Williams in their recent report on 'Policy for Progress' (CHEMICAL AGE, 28 November, 1959, p. 765).

Lord Hailsham, Minister of Science, says Government support for scientific and technological research and education is likely to continue in all directions, in accordance with plans already announced. He also reiterates his previously expressed hope that there might be an increasing expenditure on research and development by industry "now that it has security."

Chairman of the Association of British Chemical Manufacturers, Sir William Garrett, says that British chemical industry looks forward to 1960 "with cautious optimism." Much of the heavy capital investment of the last few years will come into production during this year and subject to a continuation of the present stable conditions, there are "good prospects that this new capacity will be fully operative."

Clouding the picture somewhat, however, is the 'Outer Seven' convention. The industry, states Sir William, does not regard this with the same enthusiasm as it would a grouping of the 13 European countries. It is nevertheless accepting the challenge both in the home market and in the export field. The hope is expressed that 1960 will see some effort of rapprochement between the Treaty of Rome countries and those subscribing to the Stockholm Convention.

The 60's will, we believe, be exciting and progressive years for the chemical industry. They will, however, call for more research and greater efficiency in production to meet the increasing competition, for on these factors will rest the U.K. chemical industry's share of the world's markets.

DIMETHYL ISOPHTHALATE

NOW being produced on a multi-million-lb. a year scale by Montrose Chemical Co., at their Newark, New Jersey, U.S., plant is dimethyl isophthalate. The plant is believed to be the only one of its kind in the world.

Production of this ester is much more difficult than most esterifications, as dimethyl isophthalate hydrolyses in conventional acid-catalyst medium or water washes. Also as it is not very soluble in the usual solvent, purification to final quality is not easy. Montrose have apparently solved these problems, but just how they do so is not revealed.

A possible route is that solid isophthalic acid (melting point 80°C) and methanol (in vapour form) are reacted in a pressurised Dowtherm-heated kettle. Some liquid ester in the reactor forms a slurry with the isophthalic acid and assists the reaction. Methanol and water, taken overhead, are separated and the methanol recycled for re-use. The dimethyl ester passes forward for further distillation and final purification. Montrose's final product is over 99.99% pure ester (i.e. more than 98.0% pure isophthalate.

Dimethyl isophthalate is used in the production of polyester resins, textiles and films.

ANNUAL REVIEW & 1960 PREVIEW

HIGH SALES LEVEL WITH RECORD EXPORTS IN 1959 SHOULD BE MAINTAINED

★

'Chemical Age' Survey of Sales Trends in 1959 and Estimates for 1960

★

- **Pharmaceuticals, pesticides and fine chemicals register good sales rises**
- **Heavy chemicals and fertilisers are 'sturdy' with a steady rise over 1958**
- **Plastics materials continue to progress**
- **Coal tar products and dyestuffs both recover from doldrums of 1959**

AFTER a record year for home and export sales in 1959, the U.K. chemical industry looks forward to even higher turnovers this year. Recovery from the setbacks of 1958 started from the beginning of last year and all sectors of the industry shared in the expansion.

This return to an upswing in chemical trade, interrupted in 1958, is clearly reflected in returns to the exclusive CHEMICAL AGE survey of sales in 1959 and prospects for 1960. The third and latest C.A. sales survey confirms the results shown last year (CHEMICAL AGE, 10 January, p. 73) when it was stated that sales curves would rise steadily in 1959.

Companies returning our questionnaire believe that sales will continue to expand this year, although caution is the keynote. Much new investment took place last year and more is planned during the coming 12 months. From returns it would seem that for 1960 investment will largely cover modernisation projects and new projects of a less spectacular scale than those that have taken place in the past few years.

As in previous C.A. surveys, export performance differed broadly from section to section and even among companies in the same fields. With one or two exceptions, most companies reported a good recovery in overseas trade. This is, of course, borne out by the Trade and Navigation Accounts which for the first 11 months indicate that total chemical exports in 1959 were near the £290 million mark, £27 million up on 1958 and some £23 million higher than the previous record year of 1957.

Survey forms went to all U.K. manufacturers of chemicals and allied products. The number returned, just over 17%, was the same as last year.

Four questions were asked: (1) Percentage increase or decrease in 1959 of (a) total sales over 1958; (b) exports over 1958; and (c) the rise or fall in total sales expected in 1960. (2) If 1959 sales were higher, was this due to extension of facilities or the introduction of new products over the past five years? (3) By what approximate percentage did investment increase in 1959 in replacements, extensions, new plant, research and development? (4) Are companies planning expansion of existing facilities or any entirely new projects?

Of all firms replying, 70.2% said that increased sales were due to the extension of facilities and 75% of the total also said that higher sales came from products introduced in the previous five years. Average increased expenditure on investment from all companies was as follows: on replacements, up by 8.85%; extensions, up by 10.53%; new plant, up by 8.29%; research and development showed the smallest investment increase, the 1959 average figure being up by 4.29%.

Just over 77% of companies replying are planning to expand existing facilities in 1960, while 65% are planning to initiate new projects.

It is stressed that this CHEMICAL AGE survey is only aimed at revealing general trends and that the results, analysed below, do not indicate precise percentage increases in the sales of any particular chemical product or on the part of any individual company. They represent average company performances in broad sectors of the industry and the figures given are the average for each sector.

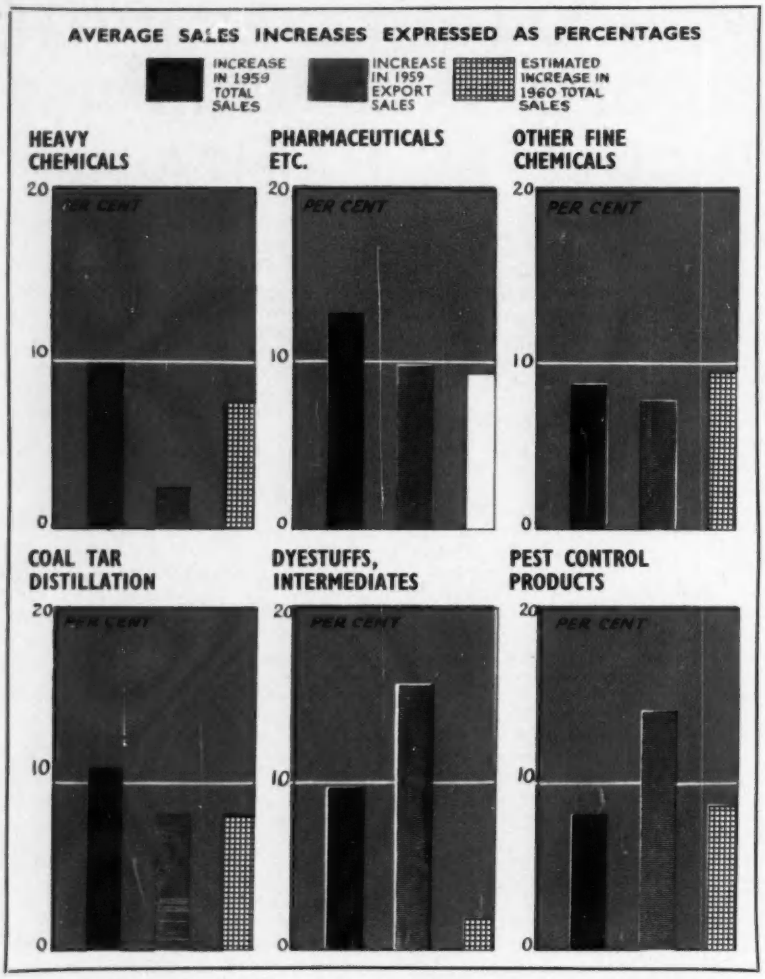
Returns that indicated extremely exaggerated trends have not been taken into account. These include a heavy drop in sales for a company engaged in transfer of production premises and a 2,000% rise in sales by one company that brought a new chemical from pilot-plant to full-scale production.

Chemical Industry Sales Trends Analysed by Groups

★

● **Heavy Chemicals.** Sulphuric acid production is a good barometer of industrial growth both of the state of the chemical industry and British industry as a whole. Last year, U.K. acid production, based on the first nine months averaged 196,700 tons a month, an increase of 5.3% compared with 1958, according to Board of Trade statistics. Consumption rose 5.2% to a monthly average of 198,000 tons. The CHEMICAL AGE survey showed a 9.4% increase in total U.K. sales of heavy chemicals, with exports 3% up over the previous year. For 1960, companies returning forms anticipate an average sales increase of 7.3%.

Increased sales were attributed to extension of facilities by 63.7% of the companies; while 45.5% of the firms said that increased sales were for products introduced in the past five years. Investment spending on replacements was up by 6.9%; on extensions, up 26.2%; on new plant, up 23.2% and on research and development, up 4.1%. More than 80% of the companies are planning to



extend existing facilities and 63.7% are planning new projects.

These results include 'industrial' as well as 'heavy' chemicals, but not bulk petrochemicals.

U.K. production and consumption of sulphuric acid is given below, the 1959 figure estimated on first nine months:

SULPHURIC ACID
(100% acid)
Production
Monthly averages in '000 tons

	1959	1958	1957
Production	196.7	186.8	194.7
Consumption* ...	198.8	189.0	197.6

* Including recovered acid.

U.K. consumption of sulphur and other materials used for sulphuric acid are shown below, figures for 1959 being estimated on first nine months:

SULPHUR, ETC.
Consumption
Monthly averages in '000 tons

	1959	1958	1957
Sulphur	30.3	26.6	27.4
Pyrites	26.0	27.3	30.6
Spent oxide	17.9	20.2	22.0
Anhydrite	62.1	62.4	61.4
Stocks			
Sulphur	78.0	98.5	95.7
Pyrites	154.0	186.2	245.7
Spent oxide	95.5	97.5	112.0

● **Fertilisers.** Too few fertiliser firms returned forms for inclusion in this survey. But it is interesting to note that the average sales increase indicated for 1958-59, 5.4%, tallies with official figures.

The British Sulphate of Ammonia Federation's annual report (see p. 77) shows that production increased over the previous year by 8.8%.

Delay in completing Shell Chemical's new anhydrous ammonia plant at Shell Haven and in reaching the designed level of output had caused some setbacks in U.K. nitrogen production states the Aikman report (see CHEMICAL AGE last week, p. 7). The outlook for 1960 is brighter, however. I.C.I. at Ardeer, for instance are building a nitric acid plant to produce weak acid by the intermediate oxidation system to replace two plants using the Du Pont pressure oxidation process and a third using an atmospheric oxidation process.

Towards the end of last year Chemical Construction (G.B.) announced a process for neutralising sulphur in flue gases by ammonia injection. If successful, the process will be of great economic importance to the nitrogen industry, for it is estimated that in the U.K. alone, neutralisation of sulphur in power station flue gases would need the production of 11 million tons of ammonium sulphate a year, entailing the use of some 250,000 tons of anhydrous ammonia.

U.K. production and consumption of fertilisers is shown in the following tables, which are based on the *Monthly Digest of Statistics*:

NITROGENOUS FERTILISERS*
(N content)
Monthly averages in '000 tons

	1958-59	1957-58	1956-57
Production ...	29.56	28.46	27.50
Home deliveries ...	27.80	25.82	25.17
Exports ...	4.00	5.34	0.70

* Ammonium sulphate, Nitro-Chalk, C.C.F., and for home deliveries, Chile nitrates of soda and potash, Trail ammonium phosphate, ammonium nitrate, nitrate of lime and cyanamide.

OTHER FERTILISERS
Monthly averages in '000 tons

	1958-59	1957-58	1956-57
Compound fertilisers (total wt. of product):			
Production	206.1	195.2	194.1
Consumption ...	198.1	199.2	190.0
K_2O content of potash	31.28	29.01	28.13

PHOSPHATIC FERTILISERS
1. Production (P_2O_5 content)
Monthly averages in '000 tons

	1958-59	1957-58	1956-57
Total	28.8	27.5	29.2
Superphosphate ...	11.6	12.1	14.7
Ground basic slag ...	6.8	6.7	6.8
Ground phosphate ...	1.4	1.3	1.5
All others* ...	9.1	7.4	6.2
2. Consumption (P_2O_5 content)			
Total	29.7	30.5	30.8
Superphosphate ...	11.1	12.6	14.4
Ground basic slag ...	8.1	8.6	8.5
Ground phosphate ...	1.3	1.4	1.5
All others*	9.0	7.9	6.4

* Organic fertilisers, treated phosphate rock, C.C.F. and triple-superphosphate.

● **Petrochemicals.** Petrochemicals continued to show the most spectacular of the chemical industry's progress in 1959 and increased their share of total organic chemical output to 50%. By the mid-1960's this share is expected to reach 70%.

Some large extensions came on stream last year, with Courtaulds increasing their olefin capacity to 40% and I.C.I. raising their's by 60% to about 230,000 tons/year. Both I.C.I. and British Hydrocarbon Chemicals are planning further olefin expansions. New plant projects in the petrochemicals field are described in a special article in p. 71.

U.K. ethylene capacity increased 20% last year over 1958 and is due to be increased by a further 25% this year. Propylene capacity should increase by 10% during 1960.

Official figure (Ministry of Power) for deliveries of feedstock for petrochemical plants in the U.K. gives a 1959 monthly average (based on first 10 months) of 83,800 tons, compared with a 1958 monthly average of 69,300 tons and a 1957 figure of 66,000 tons a month. The 1959 increase is nearly 21% up on 1958.

Sales by one company, replying to our survey, of petroleum feedstock for petrochemical use increased by 180% in 1959 over 1958, while in another case synthetic rubber sales were up by 65%. Returns in this sector were not sufficient to base an industry average and were clearly affected by new capacity coming on stream.

● **Plastics Materials.** Firms replying to the CHEMICAL AGE survey reported a 16.7% rise in total sales during 1959; this compares with an estimated increase, based on official figures of 20%. Third quarter sales totalled 122,000 tons, 25% higher than in the same period of 1958. Average rise in 1959 of exports by firms replying to our questionnaire was 5%, while a further sales rise of

(*Continued on p. 78*)

NEW EXPORT RECORDS FOR BRITISH CHEMICALS

FOLLOWING the general set back in exports in 1958, the British economy has regained its buoyancy and new records are being set for the export trade. The final figures for 1958 showed a drop of some £6 million as compared with the previous record figure of 1957. When one examines the figures for 1959, for which data are available only for the first 10 months, it seems clear that the chemical industry will establish new export records. The final total for the year is likely to be of the order of £284-£285 million. This will represent over 10% of all U.K. manufactured exports.

As a springboard for these achievements, the industry has maintained a high level of capital investment in new plant and equipment. While the 1958 figures were below those of the previous year, it is likely that in 1959 the upward trend will have been regained. This is certainly true of the index of production which continues to rise at more than twice the rate for all manufacturing industry. Based on 1954 = 100, the index in 1958 was 115, and rose in June last to 131, as compared with 113 for all industry.

Although the overall index of industrial production has not risen as sharply as for chemicals, the rapid increase in output in certain sectors and especially in the plastics industry in particular, has called for an increasing volume of chemicals to satisfy their requirements.

When one considers the main distribution of chemical exports one can see that coupled with the substantial increase in actual values, there has been an appreciable shift in the amounts sold to the main currency areas of the world. The accompanying table giving actual figures for 1957 and 1958 and estimated figure for 1959, shows that sales to the Sterling Area are approximately the same as for 1958 and as a result the actual percentage has now dropped appreciably below the 50% mark which has been a feature of previous years.

U.K. EXPORTS TO WESTERN EUROPE

	1957 £M	1958 £M	1959* £M
E.E.C. Countries			
Belgium	6.6	6.3	6.8
France	8.6	7.6	7.0
Germany	8.6	10.5	10.7
Holland	10.0	9.9	11.9
Italy	8.7	7.7	9.3
	42.5	42.0	45.7
E.F.T.A. Countries			
Austria	1.2	1.0	1.2
Denmark	4.8	5.2	5.3
Norway	4.2	4.6	4.9
Portugal	2.6	2.8	3.1
Sweden	7.4	7.6	8.7
Switzerland	3.2	3.1	3.4
	23.4	24.3	26.5

* Estimates based on first 10 months.
Source: *Trade and Navigation Accounts.*

Within this area, Australia and India remain the two major markets taking £23 million and £16 million respectively. There has also been an increase in exports to Ghana; performance has been maintained in South Africa, but there has been an appreciable drop in exports to New Zealand.

On the other hand there have been appreciable increases in exports to each of the other main currency areas. Exports to Canada have topped the £10 million mark for the first time, although it must be recognised that the U.K. contribution is a relatively small proportion of total Canadian chemical imports, most of which comes from the U.S. Exports to the U.S. and other dollar markets have also increased.

By
H. W. VALLENDER,
Association of British Chemical Manufacturers

It is natural at this time, shortly after the drawing up of the convention for the European Free Trade Association, to consider the association and the E.E.C. (European Economic Community) and their relative importance as export markets. The accompanying table shows that while O.E.E.C. (Organisation for European Economic Co-operation) countries account for nearly 30% of U.K. chemical exports, some 54% of this total are sold in the E.E.C. and only 31% in the E.F.T.A. countries. In both areas, exports have this year increased by just over 9%.

The picture is further complicated by the fact that a study of intra-European trade in chemicals shows that with the exception of Denmark all countries of E.E.C. and E.F.T.A. import more chemicals from E.E.C. than from the remainder of

Distribution of U.K. chemicals in 1959

PRINCIPAL U.K. EXPORTS

	1958 £M	1959* £M
Sodium hydroxide	4.4	6.5
Sodium carbonate	2.6	2.6
Carbon blacks	2.9	3.9
Compressed gases	2.4	1.3
Sulphonamides not prepared	1.1	0.7
Crude chemicals from coal, petroleum and natural gas	2.9	4.0
Synthetic organic dyestuffs	10.1	12.4
Pigments, paints and varnishes	23.4	25.3
Drugs and medicines:	37.6	39.6
Vitamins	2.5	2.8
Antibiotics	8.3	7.6
Alkaloids	1.3	1.6
Sulphonamides	1.2	0.9
Synthetic detergents	6.3	6.3
Fertilisers	5.1	3.3
Explosives	10.5	10.3
Plastics materials	32.1	39.0
Pesticides	5.3	7.7
Tetraethyl lead compounds	11.4	12.4
	261.5	284.4

* Estimates based on first 10 months.
Source: *Trade and Navigation Accounts.*

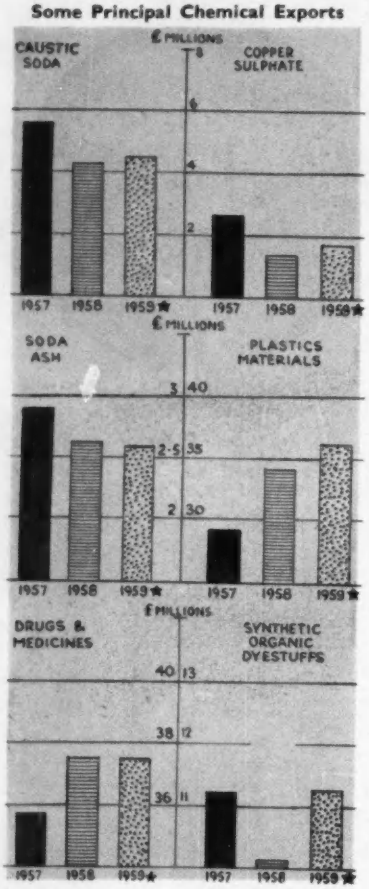
DISTRIBUTION OF U.K. CHEMICAL EXPORTS, 1957-59 IN £M

	1957 £M	1957 World Total %	1958 £M	1958 World Total %	1959* £M	1959* World Total %
Sterling Area						
Total	130.6	49.1	126.3	48.2	126.4	44.4
Sterling Commonwealth	79.5	—	76.3	—	79.8	—
U.K. Colonies	31.5	—	32.0	—	30.5	—
Middle East	16.2	—	16.1	—	18.7	—
Non-Sterling O.E.E.C. Countries and Possessions						
Total	73.9	27.6	73.8	28.2	84.0	29.5
E.E.C. Countries	42.5	—	42.0	—	45.7	—
E.F.T.A. Countries	23.4	—	24.3	—	26.5	—
Dollar Area						
Total	21.3	7.9	24.2	9.2	28.5	10.0
U.S.A.	7.3	—	7.8	—	8.4	—
Canada	8.5	—	8.6	—	10.3	—
Dollar Latin America	6.0	—	7.1	—	7.6	—
Rest of World						
Total	39.4	14.7	38.5	14.7	45.7	
Non-dollar Latin America	10.8	—	9.0	—	9.5	16.1
Soviet-Eastern Europe	2.9	—	4.0	—	7.2	—
Grand Total	267.4		261.5		284.4*	

* Estimate based on first nine months.
Source: *Report on Overseas Trade*

British Chemical Exports in 1959

Some Principal Chemical Exports



* Estimated. These columns should read: Caustic soda, £6.5 m.; plastics, £39 m.; drugs, £39.6 m.; dyestuffs, £12.4 m.

O.E.E.C. In overall terms the actual figures are 67% and 33%.

With the growing industrialisation of Europe, and rising purchasing power, the demand for chemicals will continue to increase and it is therefore imperative that a solution be found to the prospective division of Europe. The serious nature of such a division will become more apparent to exporters when the further tariff changes take place in both areas in July next and more especially later when the Common Market tariff wall begins to be erected. This will in particular affect our exports to the Benelux countries where, according to the Rome treaty, duties will begin to be levied on imports from non-E.E.C. sources.

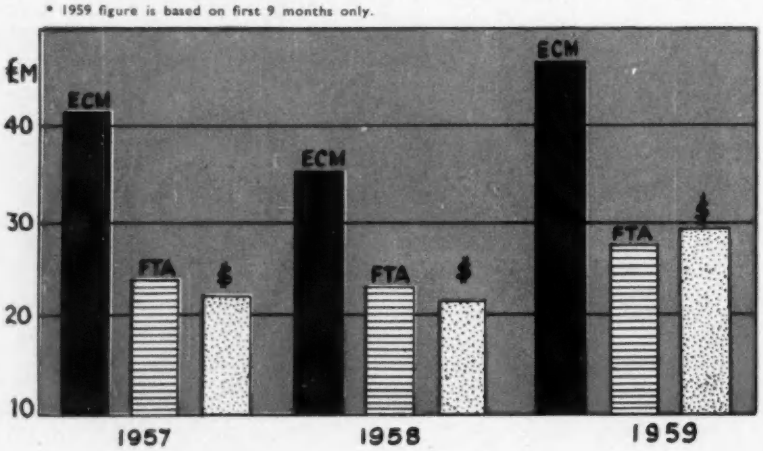
The paucity of detailed information on individual exports is well known, and it is therefore only possible to comment on changes in the broad groups for which export figures are available. Most striking increase was in plastics where there was no set back last year and which shows a further increase of £7 million. In addition there have been appreciable increases in sodium hydroxide, carbon blacks, dyestuffs, pigments and paints, drugs and medicines, where the latter have regained their position of 1957. Recovery in exports of pesticides has also occurred but little or no increases over the past year is the case with sodium carbonates, detergents and explosives.

The chemical industry can look forward in 1960 to increasing competition from many quarters. Western Germany will continue to be the principal competitor but the growing chemical industries of Western Europe, coupled with a more intensified export drive by the U.S., will undoubtedly add to the problems of exporting.

In spite of this, the chemical industry believes in its future and backed by continued capital investment and research, will strive to improve its position as the third largest exporting industry in the U.K.

Exports to European Common Market, Free Trade Area and Dollar Area

* 1959 figure is based on first 9 months only.



Prospects for Canadian Chemicals

CHEMICAL production in Canada is expected to rise in 1960, although the rate of increase may not be as impressive as in 1959. In particular, it is reported that chemical manufacturers will continue to suffer from intense foreign competition in both home and overseas markets and profit margins will continue to be under pressure. This is the general consensus of opinion that emerges from statements by leading chemical companies.

President of Du Pont of Canada, Mr. H. Lank, reports that production of chemicals and allied products has been almost 10% higher in 1959 than in the previous year. This advance has absorbed most of the surplus capacity created in 1957 and 1958. Output is expected by Du Pont to rise in 1960 by about 7%.

A slowing down in the rate of addition to plant capacity in the last three years is noted. The new low in new investment, however, may now have passed, but annual production increases are expected to be smaller than in the last decade. President of Dow Chemical, of Canada, Mr. Smithers, suggests that business activity in the industry will rise by only 2% or 3%, compared with 1959. Chemical manufacturers in Canada explain that the domestic market is small and is, moreover, open to world competition, while in overseas markets restrictions are placed on the import of Canadian chemicals. The Canadian Tariff Board is expected to renew chemical duties in 1960, but it will take several years to accomplish this task.

Monsanto Canada spokesman, Mr. L. Ryan, president, estimates that an average Canadian chemical company has been earning less than 4% on its investment in the last two years, in contrast to the interest rate of around 6% on first-class industrial bonds.

P. C. Allen, president of Canadian Industries Ltd., comments that while output of chemicals and allied products advanced in 1959, the company's performance was unfavourably affected during the early part of the year by lower export sales of chemicals and by the protracted strike in the synthetic rubber industry. Activity increased as the year progressed, and a further improvement in output is expected this year.

Barring unforeseen eventualities Union Carbide Canada Ltd.'s president, Mr. A. A. Cummings, sees the outlook in general for Canadian business as distinctly favourable. Competition from low-priced imports continues to be of serious concern to Canadian economy in certain sections, the situation being aggravated by the substantial premium on the Canadian dollar, which also impairs ability to export. Relief from the exchange handicap may materialise in 1960, however, according to some informed observers.

Annual chemical sales in Canada in 1960 are expected to reach a total of $1,400 million and to account for 5½% of manufacturing production.

CHEMICALS IN WEST GERMANY

Trebling of Output in 1950's Completed Post-war Recovery

THE past 10 years have seen a development in the European chemical industry which could hardly have been anticipated in the more austere days of 1949-1950. One of the greatest phenomena of the past decade has been the tripling of production by the West German industry, the leader with the U.K. of the Continent's chemical market and a traditional trade rival. With the coming 10 years, a period in which the chemical industry will play a greater role in the general industrial field than ever before and develop to an extent that is as yet barely appreciated, it is in the interest of this country to keep a very close eye on Federal Germany as being the main contender in the struggle for Europe's major chemical producing nation. Just how serious the challenge is can be seen in a study of contemporary German development in the field of chemical production.

Position in 1950

Although the past 10 years have seen such an extraordinary growth of the chemical industry in Germany any supposition that the 1950's hold the key to the secret of the 1960's is only partly valid. In 1950 the country's chemical potential was low as the result of anti-trust measures, production limitation, lack of capital, loss of foreign customers and not least partition of Germany into East and West and the resultant loss of the important middle-German chemical industry. The increase of production during the decade, therefore—of annual average increases of between 10 and 15%—must be regarded far more as feverish rehabilitation plus development than as development from a more or less sound starting point.

As far as may be seen at present, the increase in annual chemical output in Federal Germany in the 1960-1970 period will average out at from 7 to 10% per year, the German industry now being on a common trading footing with its rivals and development accordingly 'normal.' This is the overall picture. The development as regards specific branches of the industry will without doubt continue to vary considerably as elsewhere; here the past decade may be called on quite legitimately to prove the advance of, say, plastics and synthetic fibres at the expense of classical chemicals. In this second group, annual output increase in the 'sixties is expected to be well below the overall average and lie at between 2 and 5% according to year, organics to have the edge on inorganics due mainly to the growing petrochemical industry in the country. One important product with a future apparently far less bright than a few years ago is synthetic fertilisers; with the development of producing industries in most of the under-developed countries which formerly made up an important part of Germany's markets, export sales seem doomed to drop and it is unlikely that this already overcrowded branch of output will be developed to any great extent in the coming years.

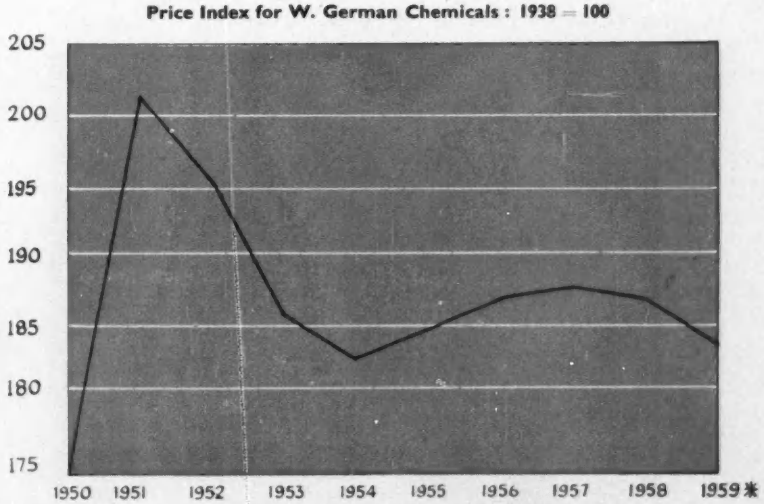
The increase in plastics production in Federal Germany, one of the world's leading producers, reached averages of from 20 to 25% in the 1950's, a trend which is as yet showing no signs of flagging; in 1959, for example, output was higher than that for 1958 by some 25% at an estimated 800,000 tonnes. For the future, however, national experts believe that a point has now been reached where although plastics output will indeed continue to increase annually, the rate of increase will fall off to some extent. Nevertheless, by 1970 a total Federal German plastics production of 2 million tonnes a year is expected in a year when total world output of plastics raw materials will not be more than 12 million tonnes according to present estimates.

Within the field of plastics, certain specific production increases are awaited. The country's polythene industry is in such a state of expansion that it is expected to reach a 1970 annual capacity of 100,000 tonnes. Great hopes, too, are being laid on the shoulders of the polycarbonates, the plastics range with excellent dielectric properties and temperature-resistance qualities now under constant development and already marketed by Farbenfabriken Bayer AG, of Leverkusen. The industrial use of plastics, such as for the manufacture of piping (p.t.f.e., p.v.c., etc.), in construction work and for containers and lighting bodies (unsaturated polyester resins) is regarded very optimistically, as is the use of plastics foils, foams and resins for consumer goods, and the number of plastics processors and manufacturers grows steadily and will continue to grow.

Not only as a plastics producer but also as a manufacturer of synthetic fibres will West Germany hold her important role in the years to come. As in other countries, market research in Germany has shown that there is a definite swing in this field towards acrylic fibres at the cost of natural and mixed materials, and production of fully synthetic fibres will rise accordingly. So rapid is this development estimated to be that by 1961 the German fibre Dralon alone will have reached an annual production capacity of 25,000 tonnes, as against a capacity for 1959 of only 10,000 tonnes. This fibre, as well as Perlon and other full synthetics, may all be looked upon as having the brightest of futures and being produced in large quantities by West Germany.

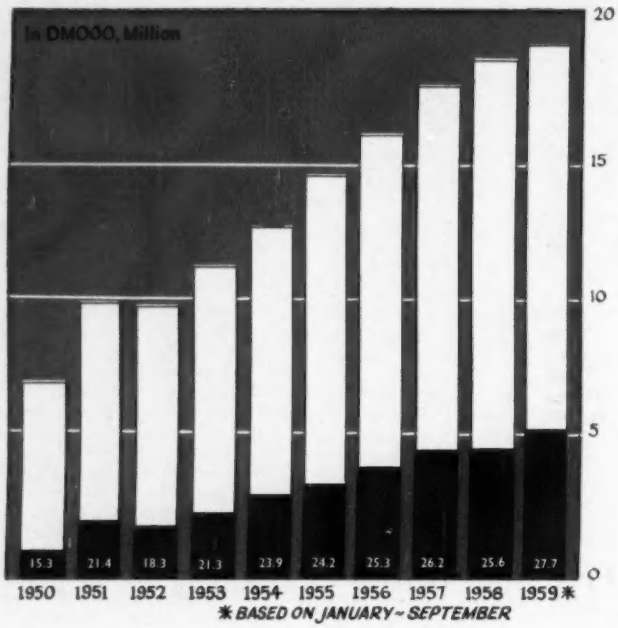
Although coal is still the main raw material for the Federal German chemical industry and will remain so in the foreseeable future at any rate, petrochemicals are to play an ever more important part in the national chemical framework. At present West Germany's main organics are based only 25% on mineral oil as against a share of 75% in the U.S. The future will bring with it another picture, though, as is evidenced by the investment in 1960 alone of over DM 1,000 million (some £83.4 million) in petrochemicals in Federal Germany. Main bodies responsible for this expansion and investment will be the firms formed by chemical and mineral oil con-

Price Index for W. German Chemicals : 1938 = 100



* BASED ON JANUARY SEPTEMBER

West German Chemical Turnover, with Exports as Percentage of Output



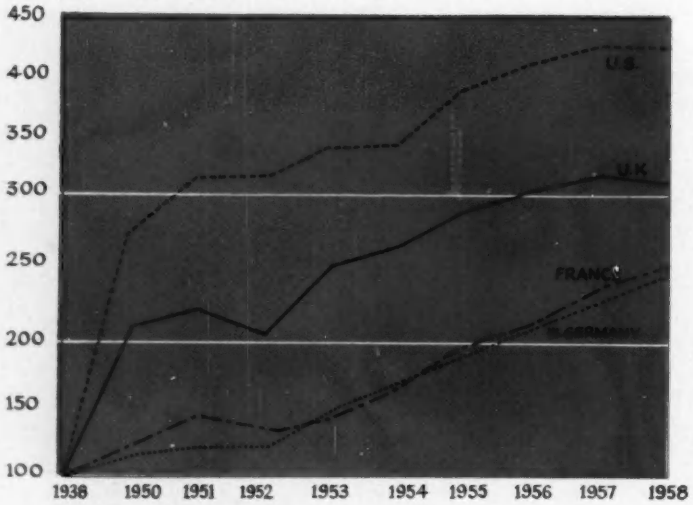
cerns especially for petrochemical production, such as Erdölchemie GmbH (Bayer-B.P.) and Rheinische Olefinwerke GmbH (B.A.S.F.-Shell).

Also high on the list for the industry's future is nuclear chemistry and the construction of atomic reactors, as well as the erection of atomic power stations for the powering of the chemical and other industries. Heavy water, now being produced by Farbwerke Hoechst of Frankfurt-on-Main, graphite and extra-pure metals are all to be produced in increased quantities to meet the nuclear programme of Euratom and of Germany itself.

A general picture of the country's intentions in chemical expansion may be gained from a study of its investment programme. From the currency reform of 1948 to the end of 1959 (last year) a total of approximately DM 11,000 million, or about £916.7 million, was invested in the national chemical industry. Until about four years ago this was centred mainly on expansion and new erection, but since then stress has been more on the modernisation and rationalisation of existing plants and this trend is expected to continue particularly in view of soaring labour costs and the difficulty in Germany of obtaining skilled staff. Taking into account a statement by the Big Three in Germany—the I.G. Farben successor companies—that they would spend an annual DM 250 million to DM 300 million (£20.83 million to £25 million) in the years 1959, 1960 and 1961, the total annual investment of the country's chemical industry in the next few years may be reckoned as lying between DM 1,500 million and DM 2,000 million (£125 million and £167 million), though by the second half of the coming decade this estimate may no longer hold good because of altered circumstances. Whatever happens, however, 1960's investment will be well above the DM 11,000 million of the past 11 years, and with research expenditure now at 3% of combined national chemical turnover and 5% of turnover in the case of the major producers, technical development can be expected to follow the trend which has made well over half the products of today's German chemical industry items which were not in production 10 years ago.

Who will buy German chemicals in the future? Most recent figures show that sales to the five neighbour countries of the Common Market bloc are growing and now account for over 24% of all chemical exports, while total exports of West German chemicals to Europe are rising even more sharply and now account for 63½% of all German chemical exports. From these figures it is easy to see that Germany is well embedded in the markets of the 'Outer Seven' group and to such an extent that it will be a thorn in the flesh of British chemical manufacturers for some time to come. The entering into effect on 1 July next of the second stage of the Common Market scheme with the lowering by 10% of inter-member tariffs will no doubt mean a greater concentration on the market area by Germany in the future, but it promises to be a long time before Germany—particularly in its role as a pharmaceutical producer—ceases to be a very important supplier to the 'Outer Seven'. Exports to outer-European countries continue generally relatively high from Germany, which will certainly not neglect them in the future. Imports to West Germany are rising constantly, too, however, with the 'Outer Seven' country Switzerland as chief supplier. Germany's most expanding chemical exports are dyestuffs, synthetic and partly-synthetic fibres and plastics.

Index of Chemical Production in France, W. Germany, U.K. and U.S.



West German Chemical Turnover and Exports, 1950-59

Year	Turnover	Exports	Chemical exports as share of W. German exports
	DM. Millions	*DM. Thousands*	*per cent*
1950	7,055.4	1,083,646	13.0
1951	9,850.7	2,113,913	14.5
1952	9,650.9	1,772,538	10.5
1953	10,889.8	2,323,979	12.5
1954	12,335.9	2,957,927	13.4
1955	14,017.9	3,396,913	13.2
1956	15,433.8	3,907,786	12.7
1957	17,185.7	4,503,766	12.5
1958	18,052.0	4,623,083	12.5
1959*	14,972.3	3,932,000	13.4

* January to September.

Index of Chemical Production

(1938 = 100)

Year	W. Germany	France	U.K.	Italy	Canada	U.S.
1950	104	121	213	140	217	286
1951	125	148	228	183	243	321
1952	127	137	215	172	254	324
1953	149	149	256	213	286	345
1954	170	170	282	262	309	345
1955	193	197	297	287	343	386
1956	210	213	310	317	371	407
1957	234	237	321	334	386	417
1958	254	264	315	362	391	414

ANNUAL REVIEW & 1960 PREVIEW

Progress in World Petrochemicals

By
Eleanor A. Mitchell, M.A.,
Techno-Commercial Department of I.C.I. (Heavy Organic Chemicals) Ltd. Billingham

Ethylene and its derivatives still predominate the world's petrochemical industries, but with rising activity, the propylene derivatives seem to have a bright future, says Miss Mitchell, in this specially contributed article. In West Europe, France has the largest capacity for the petrochemical usage of propylene. After propylene, the butylenes may be next for recognition

Figures quoted are with few exceptions based on the summation of knowledge from published estimates and statements as far as they are known. Hence no references are given

FURTHER strong development in the petrochemicals industry everywhere has been shown in 1959 and no signs of slackening are evident; total carbon content of petrochemicals made in Western Europe (including the U.K.) is expected to increase from 830,000 tons in 1958 to 1,350,000 tons in 1960—a growth of 60%. In fact, between 1957 and 1960, the European industry is expected to double its size. Rapid growth is also taking place in the U.S.

Increasing interest and activity in propylene derivatives is becoming apparent, and these seem to have a bright future—although ethylene and its derivatives are still predominant. Looking forward still further, one wonders whether butylenes will, after propylene, be the next for recognition. This article is, therefore, largely concerned with trends in the production and utilisation of the lower olefins—particularly ethylene and propylene—and their basic derivatives.

U.K. Petrochemicals Industry. In Britain, petrochemicals have continued to increase their share of the total organic chemical output—to 50% in 1959 with 65-75% forecast for the mid-1960's. Total investment in petroleum chemicals is expected to reach £140 million by the end of 1960, of which as much as £65 million will be since the beginning of 1959.

The last two years have seen in the U.K. a changeover almost completely to naphtha as feedstock, tonnage of other feedstocks now being of very small significance. It is estimated that 94% of ethylene capacity is now based on naphtha, the remainder being accounted for by refinery gas. A small amount of ethylene was made from ethanol in previous years as an interim measure before planned expansions were fulfilled.

The amount of ethylene used for polythene has increased steadily while that used for the other chief derivatives —ethylene oxide, styrene and ethanol— has remained more or less steady. This is also true of Western Europe as a whole.

In late 1959 British Hydrocarbon Chemicals Ltd. (B.H.C.) at Grangemouth commissioned an 11,000 tons per year polythene plant based on the Phillips' process. B.H.C.'s ethylene-consuming plants will operate at less than capacity rate until mid-1960, when the third olefin plant, with a capacity of 70,000 tons per year of ethylene and a corresponding amount of propylene, is planned to go on stream. B.H.C. rely largely on the adjoining Grangemouth refinery for their naphtha feedstock. They supply ethylene, under a long-term contract, for the first polythene plant at the neighbouring Union Carbide works. Union Carbide are planning to put into operation in late 1960 a second polythene plant with a capacity of about 13,500 tons per year.

Courtaulds Ltd. at Spondon were increasing the capacity of their olefin plant by 40% in 1959. Their ethylene is used in ethanol manufacture. The

TABLE 1
Capacity for Ethylene in U.K., Europe and U.S.
(tons/year)

	1956	1957	1958	1959	1960
U.K.	125,000	200,000	200,000	240,000	300,000
Europe	115,000	140,000	180,000	290,000	540,000
U.S.	1,450,000	1,550,000	1,800,000	2,250,000	2,550,000

(Capacities are as at 1 January of each year)

TABLE 2
Capacity for Petrochemical Usage of Propylene—U.K., Europe and U.S.
(tons/year)

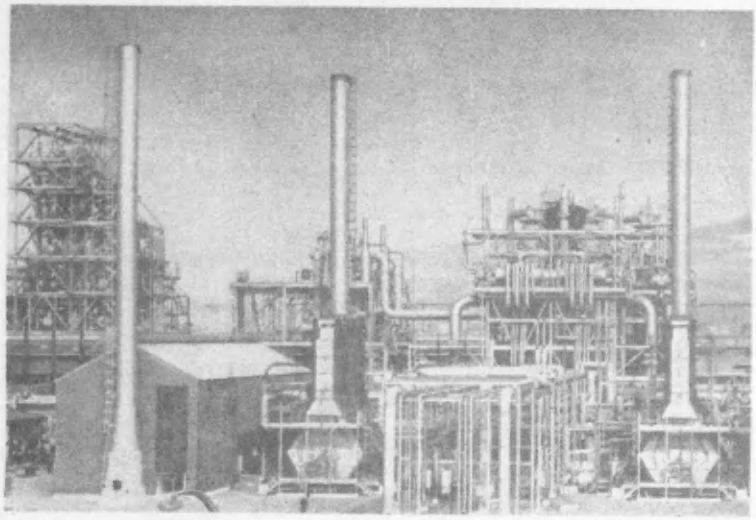
	1956	1957	1958	1959	1960
U.K.	105,000	130,000	135,000	135,000	at least 150,000
Europe	55,000	90,000	160,000	210,000	at least 300,000
U.S.	(No detailed estimates are available but capacity has increased from about 67,000 tons/year in 1956 to rather less than 1,000,000 tons/year in 1959)				

(Capacities are as at 1 January of each year)

TABLE 3
Capacity for Main Ethylene Derivatives—U.K., Europe, U.S.—1960
(tons/year)

Derivative	U.K.	Europe	U.S.
Polythene	130,000	190,000	680,000
Ethylene oxide	65,000	135,000	750,000
Ethanol	100,000 at least	small	at least 650,000
Styrene	30,000	180,000	680,000

PROGRESS IN PETROCHEMICALS



General view of No. 3 olefin plant at the I.C.I. Wilton Works

propylene is used for the production of isopropanol. Courtaulds rely on Esso at Fawley for naphtha, which is now used instead of the gas oil which was their original feed.

At Fawley, Esso Petroleum's new high-temperature oil cracker of their own design started up at the end of 1958. Eventually, it will produce, from a feedstock of light naphtha from their own refinery, 40,000 tons per year of ethylene and an undisclosed quantity of propylene. Esso supply ethylene to the adjoining works of Monsanto Chemicals Ltd. for the 10,000 tons per year polythene plant which commenced operation in mid-1959. It uses the B.A.S.F. high-pressure process.

Also at Fawley, Union Carbide planned to put on stream in late 1959 a £3 million plant to produce ethylene oxide by a process developed by themselves involving the direct oxidation of ethylene. About 22,500 tons per year of ethylene oxide derivatives including ethylene glycol, polyethylene glycol, ethanolamines, glycol ethers and carbowaxes, will be manufactured. Ethylene is supplied from the Esso refinery.

At Wilton, Imperial Chemical Industries' third olefin plant came on stream in mid-1959, thus increasing olefin capacity by 60% to about 230,000 tons per year. Total ethylene output is now 110,000 tons per year, but plans are under consideration for increasing this output to perhaps 140,000 tons per year by modifications to the existing plants. About 90% of this ethylene is used in the manufacture of polythene in neighbouring plants, and the remainder for ethylene oxide production, at present by the chlorhydrin route. Plans for extensions are at an advanced stage and a direct oxidation method may be used. Part of the ethylene oxide is converted to ethylene glycol.

Wilton propylene is piped to Billingham for the manufacture of isopropanol and butanols; plant is being installed at Wilton for refining a proportion (beyond the 95% purity at which it is already available) which will be used in a new plant for making Propathene grades of polypropylene; the approximate capacity of the plant will be 10,000 tons per year.

Capacity at Billingham for isopropanol azeotrope approaches 45,000 tons per year, most of this being converted into acetone. A third carbonylation plant started up in mid-1959, increasing capacity for the I.C.I. range of butanols and other higher alcohols to about 60,000 tons per year.

During 1958, Shell Chemical Co. at Carrington extended their ethylene units. A 25,000 tons per year direct oxidation ethylene oxide plant was scheduled to start at the end of 1959. The old chlorhydrin ethylene oxide plant is to be used for propylene oxide.

Shell have been producing ethylene and propylene at Stanlow for a considerable time by the cracking of Stanlow propane, and in addition some thousands of tons of ethylene and ethane are extracted from refinery gas. They have been importing the naphtha feedstock for Carrington by barge but, with the completion of the pipeline, will then feed Carrington direct from Stanlow or from ocean tanker. Shell, at Stanlow, are the only firm in the U.K. to produce olefins from a feedstock other than naphtha.

In general, in the U.K. at the present time, ethylene is still more important than propylene as a source for derivatives. A small quantity of propylene oxide and propylene glycol is produced and there is much activity in polypropylene, now produced in relatively small quantities by I.C.I. and Shell. But the most important derivatives from propylene are still isopropanol, acetone, butanols, and propylene tetramer. Phenol from cumene was scheduled for production by B.H.C. at a rate of 10/12,000 tons per year in late 1959; it is already produced by other synthetic methods. I.C.I. at Billingham use the monochlorbenzene route with a capacity of 15,000 tons per year of product, to be increased to 20,000 tons. Monsanto at Ruabon produce phenol on a large scale by a sulphonation process. Total U.K. capacity for isopropanol, the largest tonnage derivative, was about 105,000 tons per year by the end of 1959. Much of this isopropanol goes to acetone, production capacity for which is about 90,000 tons per year. Approximate capacity for propylene tetramer is 40,000 tons per year.

Ethylene is, however, still the prime olefin. In 1959, 41% of ethylene capacity was used for polythene, 18% for ethylene oxide, 34% for ethanol, 5% for styrene and 2% for anti-knock compounds. Total U.K. capacity for these derivatives is shown in Table 3.

The European Position. In Western Europe—including the U.K.—total ethylene capacity based on naphtha increased from about 130,000 tons per year in 1956 to 220,000 tons per year in 1958. That based on refinery gas is also still slightly increasing. Excluding the U.K. percentage ethylene capacity based on various sources in 1959 was as follows:—

	%
Naphtha	61-63
Refinery gas	20-21
Coke oven gas	9-10
Acetylene	2-3
Ethanol	0.5
Natural gas	—

As in the U.K., therefore, naphtha is the most important feedstock for ethylene in Western Europe, but refinery gas is also an important source of raw materials. In Austria ethylene is produced wholly from refinery gas, in Denmark from naphtha and in Italy from coke oven gas and naphtha. In France, raw materials are coke oven gas and naphtha, and there are plans to use the ethane in natural gas. In Western Germany, at the beginning of 1958, refinery gas, coke oven gas and acetylene each made approximately the same contribution to ethylene production, with naphtha and some crude oil contributing together only half as much as each of these main sources. By the end of 1959, the amount made from refinery gas has more than doubled, that from coke oven gas had increased by more than 50% while the contribution from acetylene had decreased. The amount made from naphtha had increased eight times, making this the predominant source as in other European countries; naphtha is also to be the raw material for a large plant now being built for the sumultaneous production of acetylene and ethylene.

Of the Western European countries, France has the largest capacity for the petrochemical usage of propylene. At the beginning of 1960 it will have an estimated annual capacity of 125,000 tons. In West Germany propylene is becoming more important and capacity for petrochemical usage of propylene is expected to increase by about 70% in 1960 to approximately 100,000 tons per year. Italian capacity, though much

PROGRESS IN PETROCHEMICALS

smaller, is planned to increase by over 100% in 1960.

Polythene is the most important use for ethylene in Western Europe as in the U.K.; 29% of total ethylene capacity was used for polythene, 27% for ethylene oxide, 10% for styrene and 14% for ethanol. The end-use pattern for ethylene varies, however, within Europe. In France and Italy polythene was the largest consumer of ethylene, but in Germany ethylene oxide was the most important. The pattern is likely to become more consistent in 1960.

Of the propylene derivatives, isopropanol, acetone and cumene phenol are the most important in Western Europe as a whole. A certain amount of polypropylene is being made in Germany and Italy. Propylene oxide is also being manufactured in these two countries.

Petrochemicals in the U.S. Petrochemicals investment in the U.S., it is estimated, will amount to £2,850 million in 1960, compared with £1,600 million in 1957.

At least 90% of the ethylene produced in the U.S. is either extracted from refinery gas or obtained by cracking the ethane or propane contained in refinery gas or natural gas. The remainder is obtained from oil and coke oven gas. Perhaps more than half of the present U.S. capacity is based on the use of refinery off-gas rich in ethane. This is in direct contrast to the U.K. and Europe where the chief raw material for ethylene is naphtha. There has been considerable further growth in the tonnage of ethylene produced purely for sale and not for internal processing to derivatives. Propylene in the U.S. is produced almost wholly as a by-product in refinery operations; nevertheless, it is significant that a very large plant is now under construction to produce ethylene, propylene and butadiene mainly from naphtha.

Most Important U.S. Ethylene Derivative

The most important ethylene derivative in the U.S. is ethylene oxide, 29% of total U.S. ethylene capacity will have been used in the manufacture of this product in 1959, 27% for polythene, 20% for ethanol, 8% for styrene and 3% for vinyl chloride. This also is in contrast to both the U.K. and Europe. The percentage for both ethylene oxide and polythene has increased over the previous three years.

Less than 10% of the propylene produced in the U.S. is used for petrochemicals. Most of it goes into polymer gasoline. Chief propylene derivatives in the U.S. are isopropanol, acetone, phenol (from cumene), dodecylbenzene, propylene oxide and polypropylene. Capacities at the beginning of 1960 are about 430,000 tons per year isopropanol, 185,000 tons per year acetone and 117,000 tons per year propylene oxide.

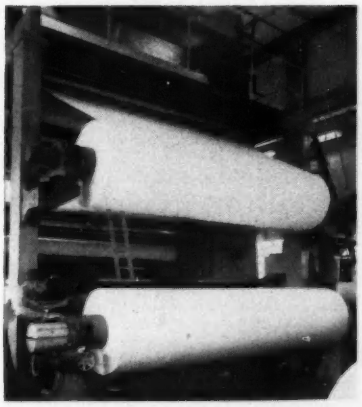
The Future. It seems highly probable that the trend towards the increasing use of naphtha as a raw material is likely to continue in the U.K. and Europe, while the U.S. petrochemical industry will be based on natural and refinery gas.

D

During the years 1959-61, U.K. ethylene and propylene capacity is expected to increase by about 60% with the large new plants of B.H.C., I.C.I., and Shell Chemical Co. coming into operation. The capacity for consuming ethylene is expected to increase to nearly the same extent, but up to now announced capacity to consume propylene will not increase by more than approximately 25%.

In Western Europe, outside the U.K., ethylene capacity will increase by more than 100%, the exact figure depending on expansions in Western Germany. France is likely to show the biggest percentage increase. Propylene capacity will also be expanded rapidly, the largest percentage increases occuring in Western Germany with the bringing into operation of plants by Erdölchemie, the B.P.-Bayer subsidiary, and Rheinpreussen, and in Italy by Sicedison and possibly by Montecatini.

The end-use pattern for olefins should show some interesting developments. In the U.K., by 1960, half the ethylene produced in the country will be used for polythene. The total capacity for ethanol may be doubled during 1960, thus restoring the end-use pattern of the mid-1950's. Polythene will become increasingly important in Europe, while in the U.S. polythene and ethylene oxide will be equally important.

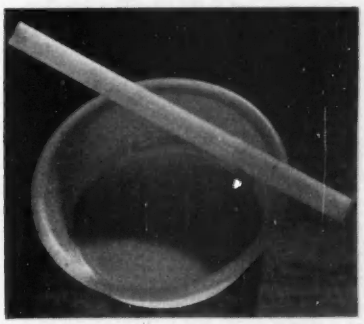


Paper being super calendered at Wolvercote Paper Mill, Oxford, with Butakon M, a butadiene copolymer latex produced by I.C.I. End uses for petrochemicals are growing in variety with the rapid development of the industry

Propylene derivatives appear to have an increasingly widening horizon. Propylene oxide and propylene glycol are already being manufactured in the U.K. and further production is planned by I.C.I. and Shell Chemical Co. Both these firms are using their increasing propylene capacity for the production of polypropylene.

Montecatini in Italy are already making polypropylene. In Germany, Farbwerke Hoechst are planning to enter the fields of propylene oxide and polypropylene. Chemische Werke Hüls are already producing propylene oxide. Expansions in these fields are also planned in the U.S.

Synthetic rubber capacity is likely to show substantial increases in Europe particularly in Western Germany.



A prototype bowl and extruded tube made from Propathene, I.C.I.'s polypropylene. Propylene derivatives such as this new plastics are attracting increasing interest

Chemical Prices Cut by I.C.I., Shell and Union Carbide

REDUCTION in the prices of some industrial chemicals have been announced by three companies—Imperial Chemical Industries, Shell Chemical and Union Carbide. Those made by I.C.I. alone, together with those announced by the company in December will represent a saving to the U.K. consumer of almost £2 million in a full year at present sales volume.

Among the I.C.I. chemicals affected are some chlorine products and sodium persalts (the latter are used in manufacture of detergents). As a result of an increase in the cost of some imported raw materials, I.C.I. have increased the price of a few other chemicals, although the effect of these increases is unlikely to exceed £60,000 annually.

Shell Chemical and Union Carbide have reduced the price of polyethylene glycol; Shell have also cut the cost of propylene oxide. Shell's reductions have ranged up to £10 a ton.

Union Carbide have since 1946 imported polyethylene glycols from their U.S. plant to the U.K. under the trade name Carbowax. It is expected that shortly Union Carbide will manufacture polyethylene glycols in the U.K. and gradually cease to import them.

Reason given for their price cuts is that demand for the products has allowed higher production and bulk deliveries. As a result, costs have been reduced.

Q.V.F. at Building Exhibition

Inquiries to the value of £500,000, chiefly for laboratory sink waste services in the U.K., have resulted from participation by QVF Ltd., chemical engineers in glass, Stoke-on-Trent, in last year's Building Exhibition at Olympia.

BRITISH CHEMICAL PLANT INDUSTRY

Encouraging Degree of Co-operation with Chemical Firms on Overseas Projects

DURING the last 10 years investment in new plant and equipment by the British chemical industry was over £1,100 million. The chemical industry is Britain's third largest exporter and its overall index of production is increasing at twice the rate of that for manufacturing industry as a whole. These figures demonstrate clearly the important part played by the British chemical plant industry which by its efforts helped to make this quite fantastic growth possible and which in the process has itself expanded not only numerically but in the technological competence of its firms.

A measure of the growth of the plant industry is the rise in membership of its representative body, the British Chemical Plant Manufacturers' Association, from 88 in 1945 to 250 at the end of 1959. Technologically the most interesting aspects of this progress have been the growth of contracting services offered by British firms, the increased number of materials of construction which are available and the ever-increasing size of individual plant units.

The part played by British contracting firms in the service of the chemical industry is well set out in the 'Chemical Age' of 26 September 1959, and it should be emphasised that there are B.C.P.M.A. members now handling projects of up to £6 million.

In the field of fabrication a great impetus has been provided not only by the chemical industry but by the nuclear power industry. A pressure shell for a reactor 70 ft. diameter and of 2 in. thick plate is now a matter of history and even thicker plate has been used. Other firms have produced large vessels in heavy gauge aluminium, while yet another has produced for the U.K. Atomic Energy Authority, what is said to be the most complicated vessel ever made in stainless steel. It goes without saying that in such fabrication the most rigorous standards of welding and weld inspection have to be met. The nuclear energy programme has further stimulated the development of new materials of construction, notably titanium, zirconium and tantalum, thus extending the range of materials available to meet the many difficult corrosive conditions in the chemical field.

Record Export Levels in 1959

What of the chemical plant industry's performance in the export field? Exports of chemical and allied plant during plant 1959 were in the order of £18 million, the highest figure ever achieved, which does not include such invisible exports as contracting services.

Without seeking to catalogue plants built by British firms overseas in recent years, a number should be mentioned to illustrate that the chemical plant industry has a good record in export markets. Over the last five years the sulphuric acid production capacity of Australia and New Zealand has been increased by 1,200 tons per day by the installation of 12 contact plants. Fourteen sulphuric acid plants have also been supplied to India during the last 10 years. Complete edible oil and soap factories have been built in Malaya and the Belgian Congo and two £1 million superphosphate plants in New Zealand.

By

E. H. T. HOBLYN, M.B.E., Ph.D., F.R.I.C., M.I.Chem.E.,
Director, British Chemical Plant Manufacturers' Association

Also, what is believed to be the largest single unit of carburetted water gas plant in the world (9 million cu. ft. per day) has been ordered for Australia from a British firm. Aruba has the largest sea water distillation plant in the world—2.7 million gall. a day—also supplied from this country.

Ever since the war there has been an understandable desire on the part of countries all over the world to make themselves self-sufficient at least so far as strategic chemicals are concerned. Where a chemical industry already exists the desire has been to expand it as rapidly as economically possible. From the above remarks about the growth of the British chemical plant industries it is understandable that these countries should seek the plant they need in Britain. It is also understandable that in so doing they should want technological help and desire that the plant should be supplied to them with complete process 'know-how'. This calls for a team effort between the chemical manufacturer who has the know-how and the plant contractor who is to build the plant overseas. Bearing in mind that his know-how is a major asset it can be appreciated that the chemical manufacturer is often reluctant to make it available to others especially if he fears the loss of an export market. It must be remembered, however, that when a country has decided to develop on certain lines it will do so and if it cannot get help from Britain, it will get it from elsewhere.

Clearly, a change in heart cannot happen overnight but it is encouraging to see the degree to which collaboration between chemical and plant manufacturers on overseas projects is developing. A number of the items on the great Russian shopping list, which did not look starters two years ago, are now moving forward and a very recent announcement regarding a £650,000 polystyrene plant for Russia provided an excellent example of this kind of co-operation.

A start in the right direction has been made but there is still a long way to go. One possible solution of the problem was suggested by the chairman, Mr. H. W. Fender, at the last annual dinner of B.C.P.M.A. namely the formation of consortia comprising sound technological groupings of chemical plant contractors and chemical manufacturers to handle large overseas projects. Even if consortia are not formed one looks to progress on the lines suggested by the principal guest at the dinner, Sir Walter Worboys, who wished to see "our chemical manufacturers and our chemical plant manufacturers working so well together that whenever a chemical manufacturer licenses a process abroad he will endeavour to arrange that a British chemical plant manufacturer builds the plant or plays a large part in its design". Development along the lines suggested by Mr. Fender and Sir Walter would greatly enchance the competitive positive of the British chemical plant industry in world markets.

Overseas Manufacture by U.K. Plant Companies

Another feature of chemical plant exporting concerns local manufacture of plant. While know-how, design and contracting services may come from this country it is not always going to be an economic proposition for all the heavy equipment to be shipped overseas and for that reason British plant manufacturers have established their own companies, for example, in India, South Africa and Australia. A further important element of local fabrication of plant which lends itself to such treatment is that foreign exchange is saved, thereby making the

(Continued on p. 77)

Fertiliser Expansions of 1959 Should Meet Rising Demands of the 1960's

By D. P. Hopkins, B.Sc., F.R.I.C.

OUTSTANDING developments of 1959, not the fertiliser year 1958/59, have been on the manufacturing side. I.C.I., Fisons, and Shell Chemical have all added new and large production facilities to their resources, with particular emphasis on nitrogen. This has raised fears that there may be some over-production of nitrogen, especially when at the same time there is some evidence that for world nitrogen the supply/demand ratio is rising. But it is foolish to form these short-term views.

These U.K. installations of increased nitrogen production have obviously not been designed to meet the particular situation at any one moment—they are forward-looking moves to deal with the prospective rise in demand during perhaps the whole of the 1960's. Without these increased production facilities the British industry might not be able to satisfy home demands at some stage in the new decade.

Developments of this major kind are not decided upon only a few months before they become realities. I.C.I. recently revealed that their several expansions of 1959 were sanctioned as financial ventures in 1955 in a £5 million scheme to extend the Billingham C.C.F. unit and to start the production of the new nitrogen-potash compound, Kaynitro; and a £3 million scheme to extend the Heysham Nitro-Chalk plant. With these additions to output in operation, I.C.I.'s annual capacity for nitrogen production is now about 275,000 tons (as N) against some 100,000 tons in 1945.

Nitrogen Sources

Until 1959, however, the sources of nitrogen for the U.K., apart from relatively minor tonnages in the form of imported nitrates and organic by-products, were I.C.I.'s synthetic fixed-from-the-air nitrogen plus the by-product sulphate of ammonia made in gas or coke works. The 1959 opening of the Shell Chemical nitrogen factory in Essex, at Shellhaven, has brought in a third large source. The annual capacity of this new factory is 75,000 tons of ammonia, or, as nitrogen, about 62,000 tons, i.e., approximately 22½% of I.C.I.'s annual production. But possibly the 'size' of this entirely new addition to home nitrogen resources is best emphasised by expressing the 62,000 tons as a percentage of total home use in 1957/58—over 20%.

The new Shellhaven works has already been described (see CHEMICAL AGE, 30 May 1959, p. 889). The ammonia is converted into ammonium nitrate, which in turn is converted into Nitra-Shell, previously sold here by Shell Chemical as an imported fertiliser. But this accounts for only 15,000 tons of the annual ammonia production, and will make about 60,000 tons of Nitra-Shell. The remaining ammonia is sold as such and pipeline transported to Fisons' new and adjacent works at Stanford-le-Hope. There it is also converted into ammonium nitrate; this, too, has previously been described (see CHEMICAL AGE, 13 June 1959, p. 975).

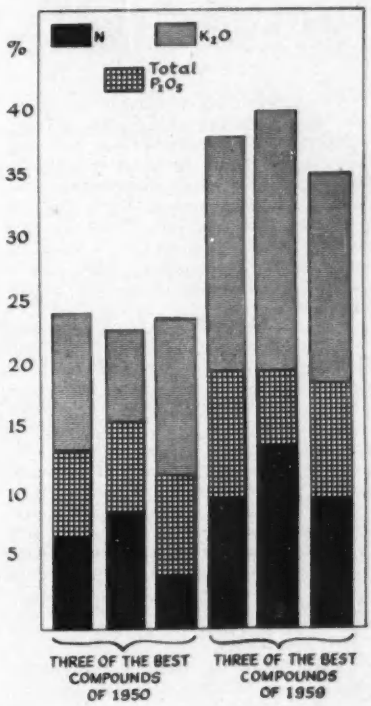
The handling of the ammonium nitrate at the Fisons' factory is undoubtedly the most novel feature of these new British fertiliser developments. It is produced as a hot aqueous solution, of about 88% concentration and with a crystallising temperature of 85°C. It is stored at Stanford-le-Hope at 120°C. In its hot, fluid form it is rail-transported or road-transported to most of Fisons' compounding factories—which involves journeys to Devon, Yorkshire, Lancashire, Lincolnshire, etc. Fleets of steam-coil heated road tankers and rail wagons have had to be built and service organised for this remarkable task, and the various receiving works equipped to take in the hot, fluid form of nitrogen.

Partial Replacement

This is being used as a partial replacement of the sulphate of ammonia hitherto used in the manufacture of Fisons' compound fertilisers. As sulphate of ammonia contains 21% of nitrogen and the 88% ammonium nitrate solution contains rather more than 30%, this development introduces yet another means of raising the plant-food contents of compounds, another step forward along the path of concentration. Indeed, soon after the opening of their new works in Essex, Fisons announced two additions to their compound list, high NPK mixtures with 16% and 14% of N.

Apart from regarding these developments as additions to nitrogen supply, they also represent some extent of change in the form of nitrogen used as a base fertiliser. The I.C.I. expansion involves no such change—compounds from the new C.C.F. plant derive their nitrogen from ammonium phosphate as did compounds from the original plant. The joint effect of the Shell Chemical and Fisons' works is to replace some ammonium nitrogen in compounds with some nitrate nitrogen. There are, of course, differences in soil action for these two forms of N.

Both are quick in action but the nitrate form is the speedier; against this, the nitrate form is readily washed out of soils by rain whereas the ammonium form is fairly well held by soils. Ammonium nitrate hitherto in British fertiliser use has been the basis of Nitro-Chalk and the much more recent Nitra-Shell, but these fertilisers, unlike compounds, are almost always used for top dressings in the spring or summer; they are seldom used as base dressings before or at the time seeds are sown. Indeed, compound use has tended to become steadily earlier in the spring seasons because our highly mechanised farms can get through the sowing programmes so much more speedily.



Plant food contents of 'typically' strong compounds of 1950 and 1959 compared, not including I.C.I.'s C.C.F.

It is one argument that the more highly concentrated compounds now made possible can provide the full nitrogen needs of the crop in a single seed bed dressing. It is another argument whether for our climate some of this nitrogen should be provided as nitrate nitrogen and not as ammonium nitrogen. Heavy rain after sowing might wash out nitrate nitrogen before the very young seedlings have taken up much nitrogen.

There has not been much published research on this aspect of ammonium nitrate's use, although one paper comparing calcium nitrate and sulphate of ammonia for spring cereals might be referred to (F. V. Widdowson, A. Penny and R. J. B. Williams, *J. Agric. Sci.*, 1959, **52**, 200). This indicated that in drier U.K. areas nitrate leaching did not take place before nitrogen uptake by the crop. It could not test, however, whether this also held good in wetter districts as the trials took place in Bedfordshire and

ANNUAL FERTILISER REVIEW

Hertfordshire. There was some indication that at higher rates nitrate nitrogen retarded germination unless rain fell soon after giving the fertiliser dressing. However, this work compared nitrates with ammonium sources of N, and this is a more extreme use of nitrates than the use of an NPK compound in which some of the N is derived from ammonium nitrate and the rest from ammonium sulphate.

So far as published work is concerned we lack information about the most suitable proportions of nitrate and ammonium nitrogen for seed-bed dressings under U.K. conditions. Attention to this seems necessary if the use of ammonium nitrate in compounding is to develop. Probably the present extent to which ammonium nitrate is entering compounds is not associated with a risk of wastage by leaching, except in very wet areas where in any case concentrated compounds high in N will not often be used.

Future of Urea

There have been rumours that the next development in the direction of compound concentration is likely to be the use of urea as a partial source of nitrogen. Urea with its 44% content of nitrogen is, of course, an even more attractive source than ammonium nitrate. Its fertiliser use in other parts of the world is far from unknown, though it seems most favoured in the U.S. as a nitrogen base for foliage sprays to feed fruit trees.

Urea is, of course, much in demand as a raw material for the plastics industry; indeed, until recently this demand has so dominated supply that little work has been done to develop urea's fertiliser use. Now it would seem necessary to do some work as a prelude to any major development of urea as a source of fertiliser nitrogen. There is, for example, the question of urea's behaviour as an ingredient of a compound during the hot stages of granulation; the formation of biuret as a break-down product is a persistent problem in urea's fertiliser development, for unfortunately biuret is phytotoxic.

Some U.S. work has indicated that urea is a helpful additive for granulation, bringing about increased plasticity for granule formation and changing the crystalline form of ammonium chloride in the final product with beneficial anti-caking effects (*Farm Chemicals*, 1959, **122**, 28); however, it was advised that urea inclusions should be restricted to 20 to 50 lb. per ton of final product, which at best would enable urea to contribute only about 1.1% of nitrogen. But U.S. granulation technique differs appreciably from that in the U.K. and it is unreliable to apply over-precisely the findings of one to the conclusions of the other.

In last year's annual report (see CHEMICAL AGE, 10 January, 1959, p. 79), the Small Farms Scheme, then only just introduced, was mentioned as a farm improvement plan likely to increase fertiliser demand. A number of papers in farming journals during the last year have described accepted cases of small farms and the plans approved under the scheme. There is not space to refer to any of these, but it is a general feature of these cases that considerably expanded fertiliser use is part of the programme for expansion. This effect may not be appreciably noticed until 1960/61 or even later. Often the need to use appreciably greater amounts of fertiliser must await expansions in the cattle number on the farm and the buildings to house them, and not until perhaps the third year of the programme on a small farm will a higher annual fertiliser demand be firmly established. Nevertheless, the direction this new scheme is taking fully confirms the predictions of last year's report here.

It is difficult to assess whether there has been much progress in U.K. fertiliser use on grassland. There has not been another general survey of national fertiliser practice issued. One had hoped this kind of information would have been available annually. The extraordinary contrast between the grassland seasons of 1958 and 1959—the former very wet and producing grass in plenty and the latter so very dry and producing almost grazed-bare swards—have together acted as a serious handicap to the steady development of grassland fertiliser expansion. It seems certain that in both years some farming determination to use more fertilisers on grass has been weakened by having to consider abnormal conditions. Water has been a more decisive nutrient, by excess or by deficiency. This can hardly mean that consumption for grassland has dropped back; usage on average is too low for this to be considered probable. It may mean that reasonably expectable expansion has been held up.

The end of the 1950s rather than the end of a single year is a fitting time to reflect upon the advances made by the British fertiliser industry. When the 1950s began a sizeable proportion of compounds was still supplied in powder form, but fairly early in the 1950s this manufacturing revolution had become practically universal for farm-used mixtures. With it there began a steady increase in the plant-food contents per ton, partly through granulation's better control over physical condition, partly as a result of Fison's 1951 initiation of triple superphosphate manufacture in the U.K. It is interesting to compare the plant-food contents of typically 'strong' compounds of 1950 and those available at the end of 1959. (In this comparison I.C.I.'s C.C.F. product is necessarily omitted because this has been granulated since the 1930s.) There has thus been a rise in compound content of about 56%, and this is in fact an under-assessment of the actual advancement, for in 1949/50 the proportion of the then higher-analysis compounds on the total home market was smaller than the proportion of the present higher-analysis compounds available today. Industrial progress has given the farmers far better value per ton of fertiliser.

It is difficult to discuss this in terms of prices because one system of subsidy was in operation in 1949/50, included in the prices, and now another system applies to nitrogen and potash, but this is excluded from prices charged by manufacturers. However, it has recently been pointed out in an article dealing with nitrogen and I.C.I. fertilisers (*The Farm Economist*, 1959, **9**, 179) that since 1938 wage rates of workers have risen by over 250%, coal costs by almost 400%, but the price of their C.C.F. compounds only by about 180%. To cite 1938 prices may seem distant, but at any rate in 1949, if not so much in 1950, fertiliser prices had been stablished at their late 1930's levels by the direct subsidy system. Nor is it misleading to cite the price changes of one particular type of compound. The differences in price levels, having regard to plant-food contents, of most farm fertilisers are not considerable as between different manufacturers.

Better Fertilisers

Price-wise as well as in quality and nutrient content, the 1950's has been a period in which the industry has steadily improved its services to farming. This trend is certain to continue during the 1960's. Indeed most prices were reduced when the 1959/60 farming year began.

At the time of preparing this annual review the tonnage of fertiliser nutrients used in the U.K. for 1958-59 seems to be a somewhat phantom figure. This may be due to the mid-year interruption in printing services which affected some parts of the system for record keeping. It can, however, be safely supposed that consumption did not fall; and it seems very likely that nitrogen usage continued to expand, with potash following this trend, but with phosphate remaining steady rather than expansive. The very dry summer months ending the farming year of 1958/59 may well have checked some normal use of nitrogen.

Plant food contents of six 'typically' strong compounds of 1950 and 1959 compared

	Nitrogen %	Total P_2O_5 %	Potash %	Total plant-food units
Three of the 'best' compounds, 1950 ...	7	7	10.5	24.5
...	9	7	7	23
...	4	8	12	24
Approx. average				24
Three of the 'best' compounds, 1959 ...	10	10	18	38
...	14	6	20	40
...	10	9	16	35
Approx. average				37.5

SALES OF SULPHATE OF AMMONIA FOR DIRECT APPLICATION DECLINED IN 1958-59

PRODUCTION figures for 1958-59 for sulphate of ammonia and for other forms of nitrogen show, according to data produced by the British Sulphate of Ammonia Federation Ltd., an increase of 6% and 9.9% respectively.

In its 39th annual report for the year ended 30 June 1959, the federation notes that as from 1 July 1958 the subsidy on nitrogen fertilisers was increased. The subsidy on sulphate of ammonia was increased from £8 18s 6d to £9 18s 0d per ton, thus reducing the net cost of the product to the farmer in the spring to £11 10s 0d per ton. At this price the British farmer was able to buy nitrogen more cheaply than almost any other farmer in the world. Despite this inducement, the federation states, sales of sulphate of ammonia for direct application in 1958/59 declined compared with 1957/58.

Increased use of nitrogen in compounded form continues to be a striking feature of U.K. fertiliser practice, the report indicates and deliveries of sulphate of ammonia to compounders in 1958/59 were substantially higher than in 1957/58. Delay in completing a new nitrogen plant, which was expected to be supplying the compounding trade in 1958/59, caused shortfalls to be covered by imports of sulphate for a short period during the spring of 1959. Apart from this supplies of domestic sulphate of ammonia have been and still are sufficient to meet all home trade requirements and to provide a surplus for export.

During the year under review competition in the U.K. fertiliser nitrogen market has been intense. The competition has come from sellers of imported sulphate of ammonia and other forms of fertiliser nitrogen. Nevertheless, owing to the increase in home demand exports have had to be reduced. (See table.)

Prices charged to British farmers per ton (metric) delivered in 6-ton lots to buyers' nearest station for neutral quality guaranteed to contain not less than 20.6% N (20.8% N from 1 January 1956) were as below.

Prior to 1953 a discount of 1s 6d per ton per month was allowed on the spring price for taking earlier delivery. Since 1 July 1953 this discount has been increased to 2s 6d per ton per month.

Output of grade 1 salt rose slightly during the year and now represents 58% of the total by-product make. Particular attention has been paid in the year under review to achieving uniformity of crystal size.

Experimental work both in the laboratory and on a number of plants has led to the increasing use of corrosion resistant alloys and resin-based materials. This will lead to a reduction of maintenance costs. Development has continued of suitable methods of analysis for impurities in the plant liquors, which are harmful to crystal growth or cause corrosion. These methods are now described in "Summary of Research Reports" published by the Federation.

Throughout the year, the automatic acidity controller has worked well, it is reported, and the system, as applied to the semi-direct process, is regarded as having passed the experimental stage. Work on its application to the indirect process continues and a number of problems have been overcome.

World Production of Fixed N for All Purposes
('000's metric tons*)

	1957/58	1958/59
Sulphate of ammonia	2,903	3,081
Calcium cyanamide	328	327
Nitrate of soda	247	243
Nitrate of lime	368	403
Amm. nitrate for use as fertiliser	1,047	1,135
Lime amm. and nitrate types	1,482	1,633
Amm. and solus as direct/indirect fertiliser	1,123	1,297
Urea for fertiliser use	402	511
Other forms of N	2,439	2,620
Total production	10,339	11,250
% increase on prior year	11.5	8.8

* 1 metric ton = 0.9842 long ton.

World Consumption of Fixed N for All Purposes
('000's metric tons*)

	1957/58	1958/59
World total, all forms	10,059	11,091
Increase % on prior year	*9.8*	*10.3*
World total in agriculture	8,432	9,363
Increase % on prior year	*9.3*	*11.0*
Use in agriculture by Continent:		
Europe (inc. U.S.S.R.)	4,016	4,436
Asia	1,761	1,873
Africa	254	279
Oceania (inc. Hawaii)	59	57
America	2,342	2,718

* 1 metric ton = 0.9842 long ton.

N content in All Nitrogen Fertilisers
(metric tons of 2,204.6 lb.)

	1957/58	1958/59
Sulphate of ammonia	188,481	197,358
Other forms	126,281	148,415
Total nitrogen	314,762	345,773

U.K. Fertiliser Exports to 30 June 1959
(long tons of 2,240 lb.)

	1957/58	1958/59
Scandinavia	282	404
Eire	1,718	54
Holland and Belgium	4	8
Portugal	8,820	—
Spain	29,528	24,606
Other Europe	700	603
Palestine/Israel	—	—
Other Levant	8,304	3,360
India, Pakistan and Burma	10	29
Ceylon	90,686	49,708
Malaya and Brit. Borneo	53,411	41,549
Indonesia	—	20
China and Hong Kong	2,855	147
Other Asia	3,755	9,639
Canary Islands	9,746	4,871
Egypt	—	—
Sudan	2,191	—
West Africa	948	411
East Africa	5,449	1,243
South and Central Africa	2,552	3,802
Mauritius	21,548	26,374
Other African	10	6
Australia	20,848	19,899
New Zealand	1,864	1,972
Fiji Isles	6,830	5,678
Canada	266	347
U.S.	—	—
West Indies	19,875	31,811
Central America	—	1,000
British Guiana	15,636	7,804
Other S. American	59	4
Total	304,895	235,349

Nitrogen Prices Charged to British Farmers

	1952/53	1955/56	1956/57	1957/58	1958/59
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Summer	15 18 0	17 5 0	20 2 0	20 2 0	20 8 0
Spring	16 10 0	20 11 6	21 2 0	21 8 0	21 8 0

Total Production N Fertilisers in U.K.
(long tons of 2,240 lb.)

Year	England and Wales	Scotland	N. Ireland	Total	Of which Sulphate of Ammonia as such
1957	1,459,300	180,500	1,800	1,641,600	1,109,500
1958	1,459,700	171,400	1,600	1,632,700	1,098,000

Sulphate of Ammonia Only
(long tons of 2,240 lb.)

Fert. Year	England, Wales and Channel I.	Scotland	N. Ireland	Total
1957/58	697,487	136,103	49,754	883,344
1958/59	723,750	144,775	56,475	925,000

British Chemical Plant Industry

(*Continued from p. 74*)

project more attractive. This local manufacture will undoubtedly increase.

Coupled with this desire of countries overseas to develop technologically is the education and training of their young technologists. Many already come to this country either directly to firms or through such valuable schemes as the F.B.I. Overseas Scholarships Scheme. Many members of B.C.P.M.A. regularly take such men into their works, but there is a need to encourage more young men, especially those wishing for practical training in chemical engineering, to come to Britain for they can ultimately be our best salesmen.

The future then is full of interest. The British chemical plant industry is well based. It is seeking to broaden that base by collaboration with the chemical industry on overseas projects. It sees ahead a vigorous challenge from Europe which it faces with confidence.

CHEMICAL AGE SURVEY OF SALES

(*continued from p. 66*)

7.5% is expected by companies in this field next year.

The C.A. figure for exports is distorted because of the poor performance of one company. Official figures show that for the first 10 months of 1959, exports of plastics materials at £32.5 million, were 26.9% up on 1958. Shipments of polystyrene, at £2.2 million, were up by 17.2%, of polythene, £529,508, up by 33%, and of p.v.c., £5,975,062, up by 17.8%.

More than half the companies replying had extended production facilities in 1959. Investment spending was, on average, higher by 8.2% on replacements, 8.7% on extensions, 5% on new plant and 3.4% on research and development. More than 50% of the companies have plans to expand existing plants, while 80% are planning entirely new projects.

New polythene capacity has been brought in during 1959 by British Hydrocarbon Chemicals (11,000 tons/year); I.C.I's fourth polythene plant is now working to designed rates (35,000 tons/year); Monsanto Chemicals had a trouble-free start-up at Fawley (10,000 tons/year) and further expansion is already in hand (capacity is a company secret); Shell Chemical are due on stream next year with a polythene-polypropylene plant at Carrington (30,000 tons/year of polyolefins); Union Carbide should be on stream late this year with doubled capacity at Grangemouth (scheduled to produce 13,800 tons/year).

● **Pharmaceuticals.** Following pesticides, pharmaceuticals showed the biggest 1959 sales increase by companies reporting in the C.A. survey. Total sales rose by an average of 13%, with exports higher by an average of 8.6% per company. Only one company reported a decline in 1959 sales—this was 12.5% down on 1958. Sales are expected to rise a further 8.5% in 1960.

This section of the industry has not looked back since the end of the war and this year exports, at an estimated £39 million, will be 5.6% higher than in 1959. Exports of vitamins rose, although antibiotics were down on 1958.

Increased sales were attributed to extended facilities by 61% of companies reporting and to new products by all companies. Capital expenditure was up by an average of 6% on replacements, 3.3% on extensions, 5.9% on new plant and 4.3% on research and development. 80% of the companies replying plan to extend existing plants or to initiate new projects.

● **Other Fine Chemicals.** Total sales in this sector rose by an average of 8.57% per company in 1959, with exports higher by an average of 7.69%. Companies reporting anticipate a 10.0% rise in 1960 turnovers. Only two companies reported lower 1959 sales increases this year, ranging from 2% to 30%.

Half of the companies reporting said that higher sales were due to extended facilities; 70% attributed their increases to products introduced in the past five years; one reported that improved processes had led to higher sales, while another referred to the development of new markets, particularly in the smaller countries. Investment spending was up as follows: on replacements by 6.8%; extensions 13.8%; new plant, 6%; research and development 6.3%. Of the companies 77% plan to extend existing facilities and 33% envisage entirely new projects.

● **Pesticides.** Survey returns show an average total sales increase for pesticides in 1959 of 8.6%, with actual increases ranging from 1% to 48%. Exports were up by an average 16.1%. Estimated average sales increase for this year is put at 9.2%. D.D.T. exports are reported to have continued to rise even above 1958 levels.

Of the companies reporting, 85.5% said that sales were affected by extended facilities, while all companies said that new products introduced in the past five years were also responsible for increased sales. Investment spending rose by 8.8% on replacement, 8.5% on extensions, 5.7% on new plant and 8.2% on research and development, the highest average figure in the whole CHEMICAL AGE survey. Just under 90% of the companies reporting plan to expand existing facilities and the same percentage also have plans for entirely new projects.

There has been a good recovery in copper sulphate despite price changes, with exports up by nearly £500,000 to £1.9 million in the first 10 months. U.K. production in the first 10 months totalled 27,218 tons, or 27.0% higher than in the same period of 1958. This recovery from the poor levels of 1958 is expected to continue in 1960.

● **Coal Tar Products.** All the companies reporting in this sector in our last survey had experienced lower sales in 1958; in the current survey all reported higher sales, ranging from an increase of 2% to one of 18%. The average increase in total sales was 10%, with exports up by an average 8%, and only one company felt it could not forecast a 1960 trend, and the average increase looked for this year is 8.0%.

All the companies reported that facilities had been extended in 1959 and all have plans for further extensions; 61% are planning entirely new projects. Investment spending was up by 1.1% on replacements; 3.1% on extensions and new plant and 9.2% on research and development, the latter figure being exaggerated by one company's laboratory modernisation project.

Gas Board production of crude benzole during the six months ended September, totalled 10.6 million gal., a decline of 2.8% on the same period of 1958, while crude tar production, at 758,000 tons, was down by 7.1%.

With exports of coal tar down £153,000 to £709,581, cresylic acid up £293,000 to £825,000 and creosote oil up by £202,000 to £1,211,157, January-October exports of all mineral tar and crude chemicals totalled £3,104,330, a rise of 21.8% over 1958.

Estimated output of carbonisation by-products in 1960 is given by one source as follows:

	'000 *Gall.*
Motor benzole	40,000
Benzene (pure & nitration grades)	30,000
Benzole (90's & other grades)	500
Toluene (nitration)	5,000
Toluole (90's)	3,000
Xyloles (all grades)	4,000
Naphthas (all grades)	10,000
Pure pyridine	100
Pyridine bases:	
90/140	4
90/160	35
90/180	30
Other Grades	54
	'000 *Tons*
Naphthalene	
CP <75.9°C	10
76-78.5 C	55
78.5 C	5
Anthracene (40's)	3

The 1960 naphthalene estimate of 70,000 tons compares with a 1958 total of 49,000 tons.

● **Dyestuffs.** As in coal tar products, all companies reporting experienced increases in total sales during 1959, ranging from 5% to 21% higher than in 1958. Total sales averaged an increase of 10.1% per company, with exports higher by an average of 15.5%. Of the companies in this sector, 61.2% felt that there would be no change in the 1960 sales pattern, while the average figure was 2.1%.

Each of the companies reporting felt that new products were partly responsible for their higher sales; all the companies had extended their facilities in 1959 and all anticipated further expansions; none of them had plans for entirely new projects.

Investment spending increased by an average of 5% on replacements; 1.7% on extensions; 35% on new plant. There was no increased expenditure on research and development.

● **Miscellaneous.** Returns for a number of chemical industry sectors were not sufficient for analysis, but the following brief points might interest other companies in the same fields. *Fats, etc.* Total sales down by an average of 1%, compared with an average decrease last year of 9%. *Pure Metals.* Total sales up by 40%, with a 50% increase in spending on replacements and extensions, and a 10% rise in spending on research and development. *Disinfectants.* Total sales up by an average 5%, with exports down; estimated 1960 sales increase is 9%.

We gratefully acknowledge the assistance kindly provided by the many companies which helped us to complete this survey.

U.K. Tetraethyl Lead Usage Rises by 16.2%

U.K. consumption of tetraethyl lead in the first 10 months of 1959 totalled 19,151 long tons, compared with 16,155 long tons in the same period of 1958, an increase of 16.2%. Other lead production figures for January-October were: Battery oxides 22,115 long tons (21,909); other oxides and compounds, 22,357 long tons (21,267); white lead, 6,771 long tons (7,531).

Project News

£3.75 m. Coke-Oven and By-Products Contract for Simon-Carves

● ONE of the largest contracts placed in the U.K. in recent years for coke ovens and worth about £3.75 million has been awarded to Simon-Carves Ltd. by Richard Thomas and Baldwins Ltd. The contract is for the coke ovens and by-product plant of a new hot strip mill to be built at the Spencer Works at Newport, Mon.

The plant will comprise 140 ovens capable of carbonising approximately 2,860 tons of dry coal a day, with a by-product plant to recover tar and crude benzole and to produce sulphate of ammonia. Work on the site is expected to begin early this year. The first stage of the plant will be in production in September 1961, and the remainder will go into production a month later.

Simon-Carves are also one of the contractors for the Port Talbot Chemical Co.'s hydrorefining plant that will refine coke oven crude benzole to pure benzene. (See CHEMICAL AGE, 21 November, p. 731.)

● CONTRACT has been awarded to G. Wimpey and Co. Ltd., 27 Hammersmith Grove, London W.6, for design, procurement and construction of a polythene plant at Altona, Victoria, Australia. The contract, worth some £A4 million, has been placed by Union Carbide (Australia) Ltd.

● A CONTRACT has been gained by Blaw Knox Chemical Engineering Ltd., 20 Eastbourne Terrace, London W.2, from National Adhesives Ltd., Slough, for an additional polyvinyl acetate emulsion plant to be erected at the National Adhesives factory at Slough. The plant is scheduled for completion in mid-1960.

As well as extending the wide range of adhesives already produced by National Adhesives, the new resins, it is stated, offer further fields of development in the paint, textile and paper industries.

● THE West Midlands Gas Board has awarded a contract worth £6.5 million to Woodall-Duckham Construction for the installation of high-pressure coal-gasification plant on a new site at Coleshill, Warwickshire. The installation will include tonnage oxygen plants, Lurgi-type complete gasification generators, and extensive ancillary equipment for gas treatment and enrichment, by-product recovery, effluent treatment, and coal and ash handling.

Gas manufacturing capacity will be 40 million cu. ft. daily, and provision made for future extension in two stages to 80 million and 120 million cu. ft. daily. The generators are designed to gasify low rank, small coals from the Midlands coalfields. Woodall-Duckham will start from the green site and continue to full gas production from the installation in 1963.

Chromatography work Earns C.B.E. for Dr. A. J. P. Martin

DR. **William Henry Glanville,** director, Road Research Laboratory of the Department of Scientific and Industrial Research; and **H. S. Wilson Massey,** Quain Professor of Physics, University College, London, are among the **Knights Bachelor** in the New Year Honours List.

C.B.E.

Dr. A. J. P. Martin, research director of Griffin and George Ltd., well known for his work in development of chromatographic analysis, for which he was awarded the Nobel Prize for Chemistry jointly in 1952, is awarded the **C.B.E.,** which has also been conferred on the following: **Mr. E. G. S. Elliot,** lately chief technology planner of the Ministry of Housing and Local Government; **Mr. D. C. Martin,** assistant secretary of the Royal Society; **A. T. R. Mattick,** lately deputy chief scientific officer, National Institute for Research in Dairying; **H. T. Pledge,** Keeper, Science Museum; **H. T. Ramsey,** director of Safety in Mines Research Establishment.

Dr. A. J. P. Martin, a joint holder of the Nobel Prize for Chemistry (1952), who was also awarded the Swedish Berzelius Gold Medal in 1951

O.B.E.

T. Barlow, resident engineer, Windscale Works, Cumberland, U.K.A.E.A.; **J. S. Hales,** director, Industrial and Domestic Development Laboratory, British Coal Utilisation; **H. W. Pout,** senior principal scientific officer, the Admiralty; **E. T. Wilkins,** principal scientific officer, Department of Scientific and Industrial Research; **F. R. Winn,** chief executive officer, Board of Customs and Excise.

M.B.E.

S. G. Aberdein, lately commercial manager, North Thames Gas Board; **P. E. J. Lindcroft,** Chartered Institute of Patent Agents; **C. MacDonald,** director and general contracts manager, Wailes Dove Bitumastic Ltd.; **Miss A. Mitchell,** group labour manager, Risley, U.K.A.E.A.; **R. Redstone,** senior scientific officer, Admiralty; **R. L. L. Robinson,** regional fuel engineer, National Industrial Fuel Efficiency Service; **J. H. W. Simmons,** senior principal scientist, A.E.R.E., Harwell; **Miss W. M. Springford,** principal secretary to the chairman of the I.C.I. Ltd.

B.E.M.

J. B. Atherton, electrical welder, Billingham Division, I.C.I. Ltd.; **J. Ramage,** process superintendent, Grade I, U.K.A.E.A.; **G. B. Richardson,** gas welder, Ashmore, Benson and Pease Co. Ltd.

Two Nuclear Power Groups Amalgamate

IT HAS been agreed that the two companies, The Nuclear Power Plant Co. Ltd., and A.E.I.-John Thompson Nuclear Energy Co. Ltd., become partners on an equal basis in all respects as from 1 January 1960, under the name of the Nuclear Power Group. The head office of the Group will be at Radbroke Hall, Knutsford, Cheshire. The constituent members are: Associated Electrical Industries Ltd.; Clarke, Chapman and Co. Ltd.; Alex. Findlay and Co. Ltd.; Head, Wrightson and Co. Ltd.; Sir Robert McAlpine and Sons Ltd.; C. A. Parsons and Co. Ltd.; A. Reyrolle and Co. Ltd.; Strachan and Henshaw Ltd.; John Thompson Ltd.; Whessoe Ltd.. Each partner will have three representatives on the board. (See 'People', p. 97).

Pharmaceutical Imports from Dollar Area

Details of applications for licences, etc., for imports of packed pharmaceutical preparations from the Dollar Area, now subject to a quota of £200,000 c.i.f., are given in the Board of Trade Notice to Importers No. 927, dated 2 January. (The Token Import Scheme has been discontinued.)

Another New Fisons Company Formed

NEWS of the formation of Fisons Fertilisers Ltd. has been promptly followed by a further announcement, that this new entity will have its own subsidiary, Fisons Horticulture Ltd., which is to be in effect the horticultural department of the first-named new company.

With assets exceeding £1 million, the horticultural company will be responsible for manufacture and sale of fertilisers, weedkillers, insecticides, etc., for commercial growers and also for amateur gardeners in the U.K.

The board of Fisons will continue as before, with two exceptions. (See CHEMICAL AGE, 26 December 1959, p. 932, for details of Mr. C. E. Horton's appointment as vice-chairman of the parent company, and page 98 of this issue for further information on the board.)

Clayton Aniline Christmas Dinner

Some 100 pensioners of Clayton Aniline Co. Ltd. were given a Christmas dinner at which they were joined by their former works managers and supervisors.

★ NEW YEAR resolutions, they say, are made to be broken. At least the chemical industry has started 1960 in the best possible way and one that will bring delight to Mr. D. Heathcoat Amory, Chancellor of the Exchequer. That is if the industry's obvious resolve to prune its prices wherever possible is maintained. Our 2 January issue heralded price cuts for polythene by I.C.I., lower prices for butyl rubber and polyisobutylene by Esso, and reduced prices for industrial alcohol, and two sebacate plasticisers by Distillers.

This week's issue brings even more reductions from I.C.I. on industrial chemicals—said to represent savings to the U.K. industrial consumers of £2 million in a full year. Shell have cut their propylene oxide and polyethylene glycol prices by up to £10 per ton, while Union Carbide, too, have cut petrochemical prices (p. 73). British Oxygen Chemicals have cut their price for melamine (p. 105).

The Board of Trade's price index for November shows a figure, based on a 1954 average of 100, of 104.9 for total chemical sales, only 0.2 points higher than a year earlier. Indexes for general chemicals (106.3), pharmaceuticals (81.8), detergents (103.6) and synthetic resins and plastics materials (90.0) were all down on the previous year.

★ WITH tetraethyl lead consumption in Britain up 3,000 tons in the first 10 months of 1959 over the same period of 1958, I was interested to hear this week from the Mobil Oil International headquarters in New York that the company is now thinking of using a new anti-knock petrol additive—tetramethyl lead. The product is said to boost the octane rating of certain types of petrol components more than T.E.L., the most commonly used additive to eliminate knocking in car cylinders.

Mobil have asked tetraethyl lead producers for estimates on the commercial production of tetramethyl lead. If they decide to go ahead with this new product, they will need the approval of the U.S. Public Health Service before placing it on the market. The only U.K. manufacturers of T.E.L. are Associated Ethyl at Ellesmere Port and Northwich.

★ Now that Indian Explosives Ltd. have accepted the Gomia explosives factory as an operating concern and I.C.I. Nobel Division's responsibilities for fully commissioning the plant have ended, four of the starting-up party have returned to the division. Some others are returning by sea, leaving Bombay in mid-January. Eight other members and eight instructors will return later this year. Additional engineering personnel went to Gomia last autumn to help overcome difficulties in acids plants maintenance. Most of the problems have now been resolved.

Dr. J. M. Holm, a joint managing director of Nobel Division, flew out to India for the final week of a four-weeks' trial at full production load. He found that the designed rate of production was exceeded by 8%. The plant is designed to produce blasting explosives and safety fuses, the latter unit being still under construction. It is hoped to start up safety fuse production in June, using imported fuse powder; later the necessary powder will be made at Gomia.

Already Indian Explosives are planning increases in the capacity of both blasting explosives and safety fuses. This development will largely be the responsibility of the Indian Company, but Nobel Division will supply technical information, detailed engineering designs and some of the plant equipment.

★ IN VIEW of the tremendous advances in textiles and chemicals, the textile chemist should have one eye on the textile field and the other on the chemical field of vision and be ready to snatch at exploiting new combinations of atoms. Failing this attitude he must inevitably become a mere tester of the chemical industrial products handed to him, observes the Textile Institute's *Journal* in its current issue.

If he is to advance textile technology in the chemical field he can: (1) employ old techniques on well established chemicals with the knowledge that 'everbody's doing it;' (2) invent new techniques—which is more difficult—and again use these with known chemicals; (3) synthesize new chemicals and use both old and new techniques on these. But this is still more difficult.

In trenchant vein the institute asks "Are we satisfied with ourselves, or is there not room for an assessment of the present position and for decisions in executive quarters to organise a new drive so that the textile industry can make sure of its own progress in the chemical field for the future? It is hoped that the answer will not be *laissez faire*."

★ A SIGN of the additional control that chemists now have over the structure of rubber, comes with the news that Phillips Petroleum, Bartlesville, U.S., have developed a new type of man-made rubber that can double as a plastics material—high-trans polybutadiene. It has rubbery properties that recommend its use in shoe soles, floor tiles, and coverings for cables and golf balls; because it can be milled, extruded, melted and moulded, the new material can also be considered a plastics.

The rubber is not as stretchy as balata, but matches it for hardness and resilience. Like natural rubber, it can be vulcanised normally with sulphur and peroxides. Depending on how it is processed, the vulcanised product may vary from a hard inelastic material to one that is soft and rubberlike.

'High-trans' indicates that a large portion of the carbon atoms are arranged in a definite pattern that repeats itself consistently in the chain. Such arrangements are common in natural rubber, but have been difficult to duplicate in the laboratory until recent years. This type of polymer is unique in several ways and displays properties resembling those of both rubbers and plastics. For this reason, trans-polybutadiene is expected to be of considerable interest from the application standpoint.

★ LABOUR turnover in I.C.I. in 1959 will be the lowest for many years and it is estimated that the total cost to the company will be about £180,000—or about £40 for every employee who leaves—compared with a total of £200,000 in 1957. So reads a Plastics Division report presented to the December meeting of Plastics Works Council at Billingham.

This report also stated that only five employees have left Billingham Plastics Works this year and that the works had a voluntary labour turnover of only 1.1%.

Some labour turnover is inevitable and in fact is healthy because it allows flexibility and helps to cushion the effects of changes in production and working methods. Too much, however, is wasteful and uneconomic. Cost involved of a person leaving I.C.I. means, says the report, that time effort and cost of recruiting and training him have been wasted. Raw materials, too, may have been wasted and tools and equipment may have been damaged before the man became skilled at his work—and this is estimated at about £40 a man. Hence the cost of about £10,000 this year for Plastics Division and £180,000 for the whole of I.C.I.

The above figures are low, say I.C.I., mainly because unemployment was high earlier in the year. In 1957, which was much more like the average, the total for Plastics Division, excluding Wilton polythene, was £13,000 and for I.C.I. the cost was £300,000.

Alembic

A GOOD YEAR FOR I.C.I. ON TEES-SIDE . . .

. . . But Even Better Sales Records are Expected by H.O.C. Division in 1960

EXPRESSED views of the Tees-side division chairmen and works managers of Imperial Chemical Industries Divisions are confident regarding the prospects for 1960. Billingham Division chairman, Mr. W. J. V. Ward, states that the check in trade experienced in 1958 has given way to "resumed progress." Associated as the division is with U.K. agriculture, 1959 was a good year and this year a further large increase in usage of nitrogen fertiliser in the farming year which ends next June is expected. Also in spite of competition from producers at home and from imports, the past year has seen very steady and high outputs from almost all the works in the division and the plants in them.

The explosion in the oxygen plant in April 1959 in which three people were killed, caused damage to the plant that left the division without oxygen for the rest of the year, but arrangements both for temporary and permanent supplies are well under way. The associated oil gasification plant is also reported by Mr. Ward to be making gas for substantial and increasing amounts of ammonia. The old sulphuric acid plants have been modernised and the large new plant at Heysham to make methanol is already on stream.

Severe Competition

For the Heavy Organic Chemicals Division chairman, Dr. S. W. Saunders, states that 1959 was a good year, and although competition has been severe, the division has sold more products, both in this country and abroad than before. He sees no reason why 1960 should not be even better than 1959.

The year 1959 is one which Cassel Works might well look back on with satisfaction, records Dr. H. R. Hailes. The threat of foreign competition became serious in the first half of the year, but the challenge was accepted and as a result of the efforts of the works, production steadily increased throughout the year so that at the end of 1959, Cassel were falling behind in deliveries in some of their products in spite of plants being on maximum outputs. Even the extensions to the methyl methacrylate plant which were only brought into commission in 1958, were by the end of the year being pressed to the limit of their capacity. A plant to enable Cassel to send more hydrogen of better quality to Nylon Works has been commissioned and also another small plant for utilising an effluent for which Heavy Organic Chemicals Division had previously been unable to find a use.

Towards the end of 1959 a new unit considerably larger and more complex than the existing units, was brought into operation on the hydrogen cyanide plant. A bigger and better acetylene generator was also started up.

As 1959 passed, the acrylonitrile plant under construction at the east end of Cassels Works has been slowly but surely taking shape, and the culminating point of the year was the successful trial run of this plant. (See also p. 82.)

A particularly successful year production-wise at the Plastics Works, Billingham, with noteworthy progress achieved—so notes Dr. A. M. Bloch, Plastics Division Tees-side Works manager. Construction work on the new Diakon moulding powder plant was completed in stages and by the end of last year, production had almost reached flow-sheet rate. Demands for the product have grown and are continuing at such a level that active consideration is being given to means of increasing output beyond flow-sheet in 1960. In particular, the quality of the product from the new plant is noted as being such an improvement over the old that it is now being used extensively for the moulding of television implosion guards.

Output and efficiency on the Perspex plant are both in advance of achievements in any previous year. Extensions to the plant now being done will raise the plant capacity by 50%. These should be completed early this year and include the installation of several new pieces of glass-handling equipment which have been successfully developed during the year.

Production of coloured nylon moulding materials was introduced and after early teething troubles the unit has settled down well and now extensions are planned for early 1960.

Nylon Works, Billingham, approaches 1960 with the knowledge that demand for nylon polymer is expected to be higher than ever. Mr. W. E. Humphreys, Nylon Works manager, reports that production figures for 1959 were the best the works have achieved. To raise output still further, however, will not be easy, Mr. Humphreys remarks, and he adds that it is important to appreciate the growing range of new synthetic fibres and improved treatment of traditional materials and the increasing competition these have meant for nylon as well as foreign production of nylon polymer. The best weapons in fighting this competition, Mr. Humphreys indicates, are quality and price.

With only minor exceptions, plants at I.C.I.'s external factories have been working at full capacity, reports Dr. C. J. Bridger, Billingham Division External Factories Manager. The Nitrochalk Twenty-one plant, which started up late in 1958, settled down to steady manufacture of good quality product and further modifications are being planned to raise the output.

Prudhoe ammonia plant had the steadiest year's running it has ever had, although the output of ammonium sulphate was not as great as in some previous years, Dr. Bridger states. At Clitheroe there was a reduction in output following the record year in 1958, but the demand for catalysts is reported to already be showing signs of increasing.

Iraq Lifts Trade Boycott on I.C.I.

THE Iraqi Government has lifted its boycott on Imperial Chemical Industries Ltd., who have been Iraq's principal supplier of chemicals, explosives, dyestuffs, and paints.

The ban was imposed because I.C.I. had trade ties with Israel, which is under economic blockade by the Arab countries. I.C.I. presented evidence to the contrary and appealed for a reversal of the decision.

C.A. 1960 Directory and Who's Who

Publication of the '1960 Chemical Age Directory and Who's Who' has been unavoidably delayed owing to the seven-week printing dispute last year. We much regret any inconvenience that this delay may cause our subscribers, but the matter is one that has been outside our control. Copies should reach subscribers by the end of this month

New Rules for Contents of First-Aid Boxes

FIRST-AID boxes, cases and cupboards for all workers in factories, at docks or on building sites throughout the country have had important changes made in their contents as a result of new regulations made by the Minister of Labour, 8 St. James's Square, London S.W.1, under the Factories Acts, which came into operation on 1 January.

These changes have arisen from the advances made in medical and first-aid treatment during the last quarter of a century. (For example, antiseptics, special burn dressings and cocaine eye drops will no longer be required.) A leaflet giving advice on treatment, which has been revised in the light of such advances, must be included in each first-aid box.

Shell Polystyrene for Vinegar Bottles

A new use for polystyrene has been found by Sarson's Ltd., who will shortly use bottles of this material for retail sales of their vinegar. Made by Pioneer Plastic Containers Ltd., from Shell Chemical's polystyrene, the bottle has a red top, a clear base and a drip-proof lip.

100% CONVERSION EFFICIENCY CLAIMED FOR JAP UREA PROCESS

AS was mentioned last week Toyo Koatsu Industries Inc, Japan, are now ready to licence their new total recycle urea process (CHEMICAL AGE, 2 January, p. 8). The company introduced a partial recycle system in 1950 at their Omuta plant, recovering excess ammonia. In 1954, a partial recycle system involving gas separation was incorporated at the Sunagawa plant, but as operating costs proved unsatisfactory, research was continued and a total recycle system was developed. This system, incorporating solution recycle was adopted at the Chiba plant commissioned in 1958. Since then an improved version of the total recycle system has been developed and will be incorporated in extensions to be carried out this year at Chiba.

The 'once-through' Toyo Koatsu process (*Nitrogen* No. 4, December 1959, 28) uses excess ammonia with operating conditions in the reactor maintained at a pressure of 3,700 to 3,850 lb. p.s.i., and a temperature of 180 to 190°C. The conversion rate of carbon dioxide to urea is approximately 71%, that of ammonia being about 32%. In the total solution recycle process, higher efficiency and reduced operating costs by comparison with previous arrangements are claimed.

Operating Conditions

Operating conditions in the synthesis reactor are maintained at a temperature of 180° to 190°C and a pressure of between 3,130 and 3,270 lb. p.s.i. The molar ratio of ammonia to carbon dioxide in the synthesis feed is 3.5 to 1, a ratio chosen after extensive investigations of molar ratios in the range of between 3 and 8 to 1. The conversion efficiency of carbon dioxide feed to urea is between 57 and 58%, it is reported.

Effluent liquor from the reactor consisting of urea, water, unconverted ammonium carbamate and excess ammonia passes through an expansion valve at the outlet of the reactor and is sent to a high pressure decomposer. Excess ammonia and part of the unconverted ammonium carbamate are decomposed and separated. The liquor is then fed into a low-pressure decomposer where almost all the residual ammonium carbamate is decomposed.

Product of the low pressure decomposer is a urea solution of about 70% concentration containing a small quantity of ammonia and carbon dioxide. These unconverted materials are removed in a gas separator and fed to the recovery section leaving urea solution which is available for concentration and processing.

Excess ammonia and carbon dioxide separated in the high pressure decomposer are fed to a high pressure absorber where they meet a solution of ammonia, ammonium carbonate and water. The resulting ammonium carbonate solution is sent to the synthesis reactor. Ammonia and carbon dioxide separated in the low pressure decomposer are fed to a low pressure absorber to meet a solution obtained in the gas separator; the solution obtained is fed to the high pressure unit for use as an absorber.

Evaporation is employed to concentrate the urea solution to 90% strength and impurities, including metallic particles, are removed by a filter. The solution after concentration is passed through a crystalliser, a centrifuge and a dryer.

To obtain prilled urea Toyo Koatsu take the crystalline urea to the top of a prilling tower, the urea is melted and passed down through the tower. As very little urea sticks to the inside walls of the tower, washing equipment is not required. Subsequent coating is stated to be unnecessary as the prills are sufficiently hard.

Toyo Koatsu Co. have concentrated on a solution recycle process as steam consumption is lower than with gaseous recycle systems and it hence affords lower construction and operating costs.

The corrosion problem is minimised by using a substantial excess of ammonia and a pressure in the synthesis reactor as high as 230 kg./cm.² while at the same time the conversion rate of carbon dioxide is improved. The company claim, in fact, that it is possible to obtain a conversion efficiency approaching 100% with their latest solution recycle system with consequent saving in raw materials and utilities.

Consumption per ton of urea

Carbon dioxide	...	...	26,800 cu. ft.
Ammonia	...	...	1,290 lb.
Steam	...	...	3,525 lb.
Electric power	...	...	170 k Wh.
Cooling water	...	...	110 tons

Ilford Nuclear Emulsion Stacks for U.S.

THEIR largest-ever consignment of nuclear emulsion was despatched by air freight by Ilford Ltd., the only firm in the western world to make the material, to the U.S. on 31 December. There U.S. scientists will transport it to the West Indies where it will be flown at altitudes of 18 to 22 miles in balloons with an unprecedented volume (10 million cu. ft.).

The emulsion will record the disintegrations produced by nuclear particles coming from outer space. Analysis of the results, which it is hoped will provide more knowledge about physical laws, is expected to take about two years.

I.C.I. Acrylonitrile Plant Now on Stream

Successful completion of trials of the I.C.I. General Chemicals Division Acrylonitrile plant at Cassel Works, Billingham, has been announced. I.C.I. will themselves use some of the output for their Butakon range of butydiene-acrylonitrile synthetic rubbers, and some will go for the production of acrylic fibres, the present producers being Courtaulds and Chemstrand. Capacity is said to be adequate to meet all home market needs.

Fire Research Symposium on Flame Arresters and Relief Vents

A PROGRAMME of research into performance of flame arresters and relief vents is in progress at the Joint Fire Research Organisation, Boreham Wood, Herts, under the auspices of the Department of Scientific and Industrial Research and Fire Offices' Committee Joint Fire Research Organisation. On 19 and 20 November some of the results obtained so far, and certain problems accompanying the use of these devices were discussed at a symposium.

Papers were presented by Mr. K. N. Palmer on 'Flame arresters for industrial use,' and by Dr. D. J. Rasbash on 'Explosion reliefs for gas and vapour explosions,' and were followed by demonstrations in the laboratory. In a series of lively discussions, many important points were raised, including the use of flame arresters for storage tanks for flammable liquids, the need for certification of flame arresters, and the need for information on the use of relief vents for protecting reaction vessels and for reducing flame speed along ducts.

Some of the apparatus used in the demonstrations

Leuna-Werke May Use Synthetic Phenol in Production of Caprolactam from Brown Coal

ONE of the leading producers of plastics starting materials in the East German republic and in Eastern Europe as a whole are VEB Leuna-Werke Walter Ulbricht, of Leuna. The plant has been producing caprolactam since 1940, and today supplies its own on-the-site installations with this as a base for Miramid plastics products, the Schwarza synthetic fibre plant VEB Thüringisches Kunstfaserwerk 'Wilhelm Pieck' and the VEB Filmfabrik Agfa Wolfen, of Wolfen, as a starting material for Dederon artificial silk, the VEB Kunstseidenwerk 'Friedrich Engels,' of Premnitz, as a base for synthetic fibres and to the East Berlin firm of VEB Kunststoffwerk Aceta for Dederon wire and bristles. The base for the caprolactam itself is one mineral of which there is no lack in East Germany—brown coal.

First step in the production process brown coal-to-caprolactam is the distillation of the coal. During distillation oils and water with a phenol content are produced, which in their turn are processed by an extraction method in what is known as 'phenol oil.' This crude oil is then passed over, with crude phenol oil from other sources, to the Leuna-Werke's distillation plant. Main product of the distillation unit is pure phenol, and subsidiary products—cresol and xylenol fractions. The pure phenol is the real starting material for caprolactam.

Hydrogenation

In this second stage of production the phenol is first hydrogenated using a nickel catalyst and at medium pressure to cyclohexanol. The pure cyclohexanol —obtained by a distillation process—is then dehydrated with a zinc-ferrous contact to cyclohexanone in an 80% reaction. A bell-column is used for purifying of this cyclohexanone. Cyclohexanol not dehydrated to cyclohexanone is returned to the dehydration system. Production of both substances is fully-continuous.

A fully-continuous process for the whole programme cyclohexanone caprolactam was developed three years ago; its advantages over non-continuous production are proved by non-continuous yields of only 68.5% of the caprolactam theoretically obtainable as compared with recent yields of 85.5%. Soon, it is hoped, to be raised further to 92% of that theoretically possible.

For the final stage of cyclohexanone to caprolactam, quantities of hydroxylamine are produced from ammonium nitrite, ammonium bisulphite and sulphur dioxide in a continuous process leading via hydroxylamine-disulphonic acid ammonium to hydroxyl-ammonium-sulphate. The first two components, ammonium nitrite and ammonium bisulphite, are produced on the Leuna site and piped through to the caprolactam plant in aqueous solution, while the sulphur dioxide is produced mainly from roasting gas by the VEB Farbenfabrik factory at Wolfen.

The hydroxylamine, in the form of its sulphate in water-dissolved form, is added to the cyclohexanone in stirring containers. Liquid ammonia is fed into the mixture to neutralise the free acids and free the hydroxylamine. The reaction mixture is heated to some 90° C and converted to an ammonium sulphate lye containing fine particles of melted oximes. In a separating chamber the melted oximes are separated from the specifically heavy lye, these contain 4% to 5% water and 0.5% lye. The lye is then freed of dissolved oximes and remaining hydroxylamine by an extraction process with cyclohexanone.

The conversion of the cyclohexanon-oximes to caprolactam takes place continuously at temperatures of from 90° to 95° C. As a result of this rearrangement process caprolactam is obtained in a sulphuric acid solution. The caprolactam is isolated by a process involving the neutralisation of the sulphuric acid by ammonia liquor. Yield of this process is ammonium-sulphate lye and what is called lactam oil. This lactam oil, containing 30% water and 1.5% ammonium sulphate, is subjected to an extraction process with trichlorethylene (direct distillation being impossible due to the oil's high salts content), the product being crude lactam, which is distilled and its yield cold-rolled to pure caprolactam crystals.

Plans are being made for the further development of the process. A better product is expected to result from the future introduction of synthetic phenol from Russian crude mineral oil as starter; phenol from brown coal as used is unsatisfactory in the volume of its impurities. A longer life of the hydrogenation contact and a greater yield of cyclohexanol would also result from this change to synthetic phenol. It is also planned that a drying stage should be introduced after the oximes-lye separation to win back cyclohexanone contained in the oximes.

Cominco Begin Construction of Canadian Alkali-Chlorine Plant

STARTING the construction of a $2.6 million alkali-chlorine plant at Trail, B.C., this month, are Consolidated Mining and Smelting Co. of Canada Ltd. (Cominco). The company indicated that its decision to enter this phase of heavy chemical manufacture came with the signing of a sales agreement with Celgar Ltd., who have a $50 million kraft pulp mill and new sawmill under construction near Castlegar, 20 miles north of Trail. Cominco will supply the liquid chlorine and caustic soda required for pulp manufacture. Cominco will also produce potassium hydroxide for their own processes at Trail.

Mr. Perry, vice-president of Cominco, announcing this project, said that his company has marketed some industrial chemicals in the past, but in recent years has made new studies in this field. Chlorine, caustic soda and potassium hydroxide are logical chemicals for expansion for several reasons: production can be related to existing operations; a substantial market is nearby; and the chemicals are basic in the manufacture of other products of growing importance, such as insecticides, herbicides, ethylene glycol, calcium chloride, hydrochloric acid and sodium phosphates.

The new plant will be located at the company's chemical fertiliser complex at Warfield, about a mile from Trail. An established electrolytic process will be used requiring about 25,000,000 kilowatt hours of energy per year from Cominco's power resources. The sodium chloride needed will be obtained from the Canadian Prairie. Completion of the plant is expected by the end of 1960.

Cominco consulted with the J. T. Donald Co. of Montreal in production studies. The process chosen is well proven and equipment is standard. The installation will consist of electrolytic cells, coolers, driers, compressors, storage facilities, etc. The plant will be adjacent to the electrolytic hydrogen plant to tie in with services, shops and technical facilities.

Esso Plan 75-mile Pipeline to London

PLANNING permission to lay a 75-mile oil-products pipeline of 10 in. diameter from their refinery at Fawley to a new 20 million gall. distribution depot, near London Airport, is being sought by Esso Petroleum Ltd.

Assuming such permission is granted this will be the biggest and longest commercial pipeline for refined products to be laid in Britain. All grades of light oils will be pumped direct from the Esso Refinery to the new distribution depot, from which deliveries will be made by road into a wide area.

Proposed route for the pipeline, which will be buried to a depth of at least 3 ft. over the whole distance, will carry it under Southampton Water and under the Thames.

The pipeline will be all welded and specially protected against corrosion, and it will have an initial capacity of 1.5 million gall. a day. It is hoped to commence work this year and completion is planned for early 1963: total estimated cost will be some £2.5 million.

EQUIPMENT NEWS

Cooling Tower : Vibratory Conveyor : Process Instruments : Laboratory Apparatus

NEW Q. & Q. LABORATORY GLASSWARE NITROGEN determination apparatus, a modification of the conventional Kjeldahl method is among additions to the **Quickfit and Quartz Ltd.** range of laboratory glassware, made at Stone, Staffs.

Ammonia is entrained in a stream of air instead of steam, with the advantages that very small quantities can be estimated accurately; heating and cooling to distill are avoided; the same test tube is used for digestion and aeration, and several units can be connected in series in a small space.

A stirrer gland of the stuffing-box type is now available in Fluon; and large size lyophiliser and trap for freeze-drying and sublimation are now included in the range. Soxhlet extraction with cold solvent apparatus, of 60 ml. nominal syphoning capacity, is provided for use when it is essential to extract a solid with cold solvent; e.g., when the substance to be extracted is heat sensitive.

N. and Z. THERMOMETERS, PYROMETERS THE new **Negretti and Zambra** range comprises instruments for electrical measurement of temperature over ranges between minus 200°C and plus 1700° (minus 330°F and plus 3100°F), and size of the instruments has been standardised with an 8 in. scale for ease of reading and economy of space.

The thermo-electric pyrometers are suitable for the above 'plus' temperature, and graduation commences at 0°C or 0°F on all models.

Suitable for temperature ranges minus 200°C and plus 600°C are the electrical resistance thermometers, which are supplied in other range spans if desired.

There is also a newly-developed galvanometer range designed for incorporation in either of the above, and these can be replaced without need for recalibration of the main instrument. Further particulars from the makers, at 122 Regent Street, London, W.1.

PACKAGED WATER-COOLING TOWER A DEVELOPMENT in modern water-cooling technique, is the complete packaged cooling tower (small enough to be transported in a light lorry), designed by **Film Cooling Towers (1925) Ltd.,** Chancery House, Parkshot, Richmond, Surrey.

It has a basin, shell and splash tray made of resin-bonded glass fibre, a construction which contributes to the lightness of the unit and eliminates necessity for protective painting.

The towers, whose capacities range from 300 to 5,000 gall./hr., operate on the induced draught principle; the fan and motor, mounted on the canopy, expel the air from the top at high velocity. The cooling air entering at the foot at a relatively slow speed is circulated evenly over the base area and throughout the interior of the tower.

The packing is composed of a number of horizontal trays of parallel laths. Water is discharged from spreader troughs which run along the entire length of the tower where it flows down the grid packing changing direction through 90° in every 2 in. down the whole depth of the tower.

CENTRIFUGAL SELF-PRIMING PUMP THE Pep-Loewe range of centrifugal pumps has been increased by the addition of a new vertical self-priming unit, the VRL.225. Robustly designed for general purpose pumping duties it is suitable for handling clear or cloudy liquids up to 220°F fuel and diesel oils and other oils up to 450 seconds Redwood No. 1, and due to its self-priming characteristics can be used to handle volatile liquids.

The VRL.225 primes quickly, the dynamic suction lift amounting to as much as 28 ft. when pumping cold liquids. Capacities and heads available are 70 g.p.h. at 100 ft. of liquid and 400 g.p.h. at 25 ft. The pump occupies less than 1 sq. ft. Further details are available from **Precision Electrical Products (Stockport) Ltd.,** Lytham Street, Cale Green, Stockport.

SINEX VIBRATORY CONVEYOR A NEW type of vibratory conveyor is said to be 'considerably cheaper than the conventional magnetic design' developed by **Sinex Engineering Co. Ltd.,** of North Feltham Trading Estate, Feltham, Middlesex, is said to have all the advantages of the magnetic conveyor (except that it has a fixed rate of feed)—few moving parts, low maintenance requirements and silence of operation. Very little headroom is required, and applications for which it is specially suited are those involving the simple transfer of material from one point to another. The feed can be stopped or started at will and although the speed of travel remains constant the level of material can be altered by means of a gate to control the amount being fed.

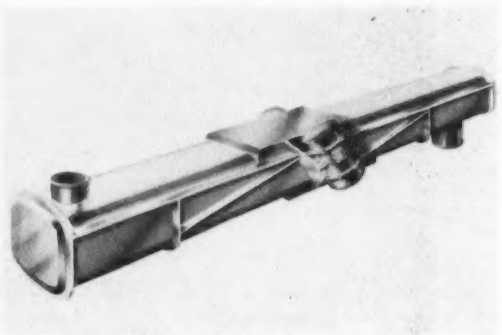
Length is adapted to customers' requirements, and the vibrators are mounted with their shafts in a vertical plane, but inclined at a specific angle to provide a feed of material in one direction along the trough. Each conveyor can be supplied complete with base structure or with simple mountings for attachment to the customers' own equipment, and special designs can be handled by the makers.

G.L.C. DETECTOR BY TINSLEY A NEW chromatographic detector has been added to their range of scientific instrument by **H. Tinsley and Co. Ltd.,** Werndee Hall, South Norwood, London, S.E.25, originally designed by Dr. D. W. Turner of Imperial College. The detector depends for its action upon changes in dielectric constant of the emergent stream, which may be either gas or liquid. Changes in the electrical capacitance of a suitably designed cell are converted into corresponding voltage fluctuations by means of an adjoining unit.

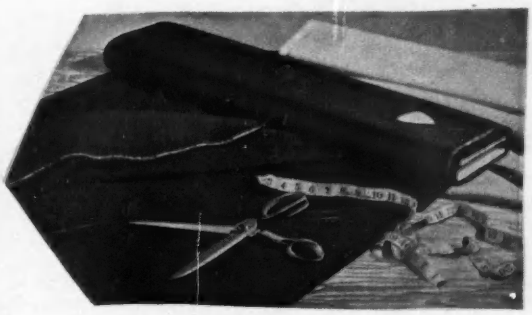
The convertor assembly is thermally insulated from the cell and its temperature remains low even when the cell reaches its normal maximum working temperature of approximately 250°C.

EXPLOSION-PROOF ENERGY REGULATOR THE Stabilag range of coarse temperature controllers has been augmented by the addition of an explosion-proof model of the Stratotherm energy regulator. It is suitable for use in hazardous and flame areas.

The wall-mounting unit is designed to take a maximum loading of 2 kW and can be used on a 220/230 volts supply; it regulates to infinity the electrical input between 10-100% of the rated consumption. The mean heating output achieved is obtained by intermittent operation corresponding to the time for which the controlled appliance is switched on and off. Price of the controller is £15, state **The Stabilag Co. Ltd.,** Mark Road, Hemel Hempstead, Herts.



Sinex vibratory conveyor



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Chemist's Bookshelf

FATTY ACIDS FOR INDUSTRY

INDUSTRIAL FATTY ACIDS AND THEIR APPLICATIONS. Edited by *E. Scott Pattison*. Reinhold Inc. Pp. 230. 56s.

A comparatively recent development in the chemical industry concerned with fats and waxes has been the marketing of specialised chemicals, fatty acids or derivatives, often of high purity, for use in the manufacture of many products, e.g. detergents, cosmetics and resins. This development has largely taken place in the U.S. and it is not surprising therefore to see this new Reinhold publication.

This book contains 16 chapters, each a short review, all by U.S. authors under the editorship of E. Scott Pattison, who also contributes the first chapter which deals with the present status of fatty acids in the chemical industry, current trends and possible future ones. This introductory chapter is followed by two dealing with the production of fatty acids from materials other than tall oil and subsequent separation of saturated and unsaturated acids. A third chapter is devoted to the isolation of fatty acids from tall oil.

In all chapters, as is the case throughout the book, emphasis is on technological problems. The various methods for carrying out a particular operation are considered critically. The fifth chapter, entitled 'Ozone and other cleavage processes', is concerned with the oxidation of unsaturated acids and their derivatives as controlled processes for the production of desired intermediates, particularly dibasic acids required for polymer manufacture. Autoxidation is not considered. The next chapter outlines the general physical properties and chemical reactions of the fatty acids, saturated and unsaturated. Necessarily there is a certain amount of overlap with other chapters, but on the whole this is an admirably concise and complete survey.

The eight chapters which follow deal with the applications of fatty acids and derivatives in various fields, viz. protective coatings (alkyd resins, epoxy resin esters and polyol esters), metallic soaps and greases, cosmetics (emulsifying agents), rubber technology (additives), detergents (esters of glycerol, sulphated and sulphonated derivatives, nitrogen containing derivatives such as amides and amines, ethylene oxide condensates), special soaps, plasticisers and copolymers derived from fatty acids (esters of hydroxy acids, epoxy esters and esters of dibasic acids) and polymers derived from vinyl esters of fatty acids. The book concludes with two chapters which describe two industrially very important matters, the handling of fatty acids in bulk and standard tests and testing methods for the analysis of fatty acids as employed in the U.S.

Production of the book is clear with many diagrams and tables. It is not and is not intended to be an academic work, but rather a survey of the field as it exists today and as it may develop. It should prove stimulating reading to many concerned with the fats and wax industries in Great Britain and is also recommended to those concerned with teaching chemical technology.

M. H. BENN.

Modern Fluidisation Techniques

FLUIDIZATION. By *Max Leva*, McGraw-Hill Publishing Co. Ltd. Pp. xiii + 327. 89s.

It is always refreshing to read a new book written by an expert. Max Leva has made a very worthy contribution to the scientific literature with this book.

Initially, in an introductory chapter, he defines all the relevant terms which are necessary to a complete understanding of the subject (the terms are given in English, German, and French), and follows on with a historical appraisal of fluidisation. Furthermore, the opening chapter deals with aspects and processes generally, even though they may be discussed in detail later in the book.

The second chapter, headed Fluidized State, covers the qualitative consideration of fluidised systems to show how dilute and dense phases may be related. This is followed by a more detailed examination of the behaviour of the dense phase, and the use of pressure drop-flow diagrams with particular reference to channelling and slugging. Fluidisation performance and the 'viscosity' of the dense-phase fluidised bed are also dealt with.

Theoretical and practical considerations for a fixed bed and the onset of fluidisation are discussed in the next chapter. Numerical examples are shown as illustrations, and a series of problems are appended to this section, as is the case where applicable elsewhere in the book.

Chapters 4, 5 and 6 deal with the expanded bed, elutriation, dilute phase and moving solids respectively. In each of these sections the material is well covered and logically presented.

The comparatively new technique of the spouted bed ('a combination of a dilute fluidised phase and a coexistent moving fixed bed of solids') is considered in Chapter 7. Heat transfer in relation to fluidised systems is discussed at considerable length in Chapter 8, and is followed by two small sections on mass transfer and the mixing of solids and fluids.

At the end of this treatise there is a useful appendix giving data for aiding the solution of problems at the end of various chapters, and a good index.

This book is well written, adequately illustrated, and gives numerous references. It will be welcomed by many industrial chemical engineers and by all those scientists who are interested in problems involving fluidisation techniques.

E. J. CHARLES.

Textbook on Fundamental Chemical Engineering Operations

NOTES ON TRANSFER PHENOMENA. By *R. Bird, W. Stewart* and *N. Lightfoot*. Chapman and Hall Ltd., London. 1959. Pp. 455. 72s.

At the outset it must be said that the practical man may be misled by the title of this book into the opinion that it treats of the problems associated with the transport of solids or fluids. The authors, however, use 'transport' in the sense of the movement of energy or matter under non-equilibrium conditions, rather than as materials handling. The reader of this journal may also find other confusions of terminology in the text, some of them not without amusement. Thus our familiar brackets become 'braces' (p. 21), non-Newtonian liquids are graphically described as being 'gooey' or 'gunky' (p. 7) and a phonetic pronunciation of Poiseuille (p. 22) is provided.

The reviewer, however, does not mean these remarks to detract from the very real importance of this book. Its authors make it quite clear that it represents the collected lecture notes of a chemical engineering course that is delivered in the University of Wisconsin as a preliminary to the study of unit operations. Anyone who has received lecture notes at secondhand via the blackboard, or who has attempted to transmit them by these means, cannot help but admire the content of such printed notes. Each section has a full explanation, together with the necessary mathematical derivation of important results, and a selection of discussion points and examples for solution.

There are numerous errors in some of the mathematical steps, but it is not useful to pursue these here, for the authors are at pains to admit to them, while asserting that the present publication is a "preliminary edition" of a textbook to be completed in the future. No doubt British technical authors would envy this facility to develop one's ideas in such a trial form, but the contents of the present book are impressive enough. Thus this book is essentially a theoretical text upon the fundamentals of chemical engineering operations, but a great deal of thought and ingenuity has been put into its presentation. Although the treatment is, quite properly, principally mathematical it is so rational as to repay study even by those whose student days are long passed.

T. K. ROSS.

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Chemist's Bookshelf

TECHNIQUES OF ION EXCHANGE

ION EXCHANGE: A Laboratory Manual, by *J. E. Salmon* and *D. K. Hale*, Butterworths Scientific Publications, London. 1959. Pp. 136. 25s (by post 1s extra).

Although the fundamental principles of ion exchange have been known for over a century, application of the technique, even to the problem of water softening, has become extensive only in more recent times. Available textbook treatments of the subject, while adequately serving for its introduction to qualified chemists, are not particularly suited to teaching of the technique in educational establishments. The present text, prepared by the authors in the form of a laboratory manual of 136 pages, is intended to fill this gap.

Following a general introduction to ion exchange, theoretical aspects are dealt with under the headings of preparation and properties of ion-exchange resins, behaviour of ion-exchange columns and ion-exchange chromatography. These chapters comprise roughly half of the manual. Of special interest are experimental procedures which can be used in the laboratory for preparation of both cation- and anion-exchange polystyrene resins, and a series of tables summarising properties of commercial resins commonly employed in ion exchange.

Practical aspects of ion exchange are covered in the next three chapters (34 pages): a short general account of techniques and apparatus, basic experiments with cation- and anion-exchange resins (e.g. preliminary treatment of resins), and some experiments in simple column operation (e.g. regeneration of a column). In the reviewer's opinion, these last two chapters might profitably have been incorporated under a single heading.

Subsequent chapters (33 pages) outline the application of ion exchange in analysis, in preparative chemistry, in purification and recovery processes and in the study of complexes, and the application of ion-exchange chromatography.

Throughout the manual, experiments are designed specially to illustrate points of fundamental importance in application of the ion-exchange process. If the process is, therefore, to be used to solve problems in either the academic or industrial sphere, provided the work is based on these models, few difficulties should be encountered. As is consistent with the concept of a laboratory manual, material is arranged, as far as possible, in tabular form. Both figures and tables are clearly presented and adequate references are given for further reading.

The book is reasonably priced and it should be welcomed by any person who has hitherto hesitated to incorporate some mention of this important subject in his teaching syllabus. It should be of particular value to anyone having to arrange a specialised course on ion exchange. Finally, the book can be recommended to qualified chemists who do not require a too detailed introduction to the technique.

M. WILLIAMS.

Development of the Chemistry of Free Radicals and Morris Kharasch's Work

VISTAS IN FREE-RADICAL CHEMISTRY. Edited by *W. A. Waters*. Pergamon Press Ltd., London. Pp. 251. 75s net.

This memorial volume to Professor Morris Kharasch, until his death the doyen of American organic chemistry, initiates a new series of monographs on organic chemistry. For 30 years Kharasch and his very large school of workers in Chicago dominated the field of aliphatic chemistry in the U.S. Before he started his investigations, the U.S. played a very subsidiary role in the development of organic chemistry. Her dominant position today in aliphatic chemistry is due partly no doubt to the astonishing development of the petroleum industry in U.S. but no less to the imagination, skill and industry of the Chicago school, led by Morris Kharasch.

Essentially of three parts, this volume comprises first, a complete bibliography of Kharasch's published work together with edited reprints of a dozen of his more important papers—for example, the early publications on the peroxide effect and the papers published in the late 30's on the mechanism of the Grignard reaction. These interesting papers, the historical value of which is unquestionable, are followed by a number of articles, each by a recognised authority, which attempt to appraise and evaluate in critical fashion, the significance of these contributions to the development of organic chemistry and in particular to the development of the chemistry of free radicals. The remainder of the volume contains a selection of papers on topics in the free radical field among which are notable contributions by Kutschke and Steacie on gas phase radical reactions and by Hey on aromatic substitution. The international character of the monograph is maintained by contributions from several Russian laboratories.

While this is a specialised monograph, with a limited appeal, there can be no doubt that all workers concerned with the investigation of free radicals will wish to possess it, if only for its historical interest.

R. C. PINK.

Compilation of Modern Formulations

MODERN MANUFACTURING FORMULARY. By *Emil J. Belanger*. Chemical Publishing Co., Inc., New York. 1958. Pp. 399. $10.

Describing this book as a compilation for chemists, manufacturers, pharmacists, technicians and students, the author gives selected formulations which require no extensive scientific knowledge. He has indeed gone to the trouble to give full practical details for making each product, as well as quoting tested formulas. The scope is enormous, from food products such as cake mixes, condiments, beverages and artificial flavourings, to household paint-removers, polishes and cements. Nearly half the text comprises the two chapters on cosmetics and medicinal preparations. There is an appendix on Federal Food and Drug Administration requirements.

The sprinkling of the text with branded names of fatty esters and surface-active agents makes it heavy going for the uninitiated, although for the U.S. reader there is a directory of manufacturers and suppliers of these compounds. Some of the polypharmaceutical vitamin tonics are calculated to horrify any manufacturer geared to the needs of the N.H.S. There are some rather unaccountable omissions; dimethyl phthalate under insect repellents for instance; and there seems a tendency among the pesticides to avoid the use of DDT and BHC. The book is well printed, lucidly set out and strongly bound, but the price, as with all such compilations, seems high.

PETER COOPER.

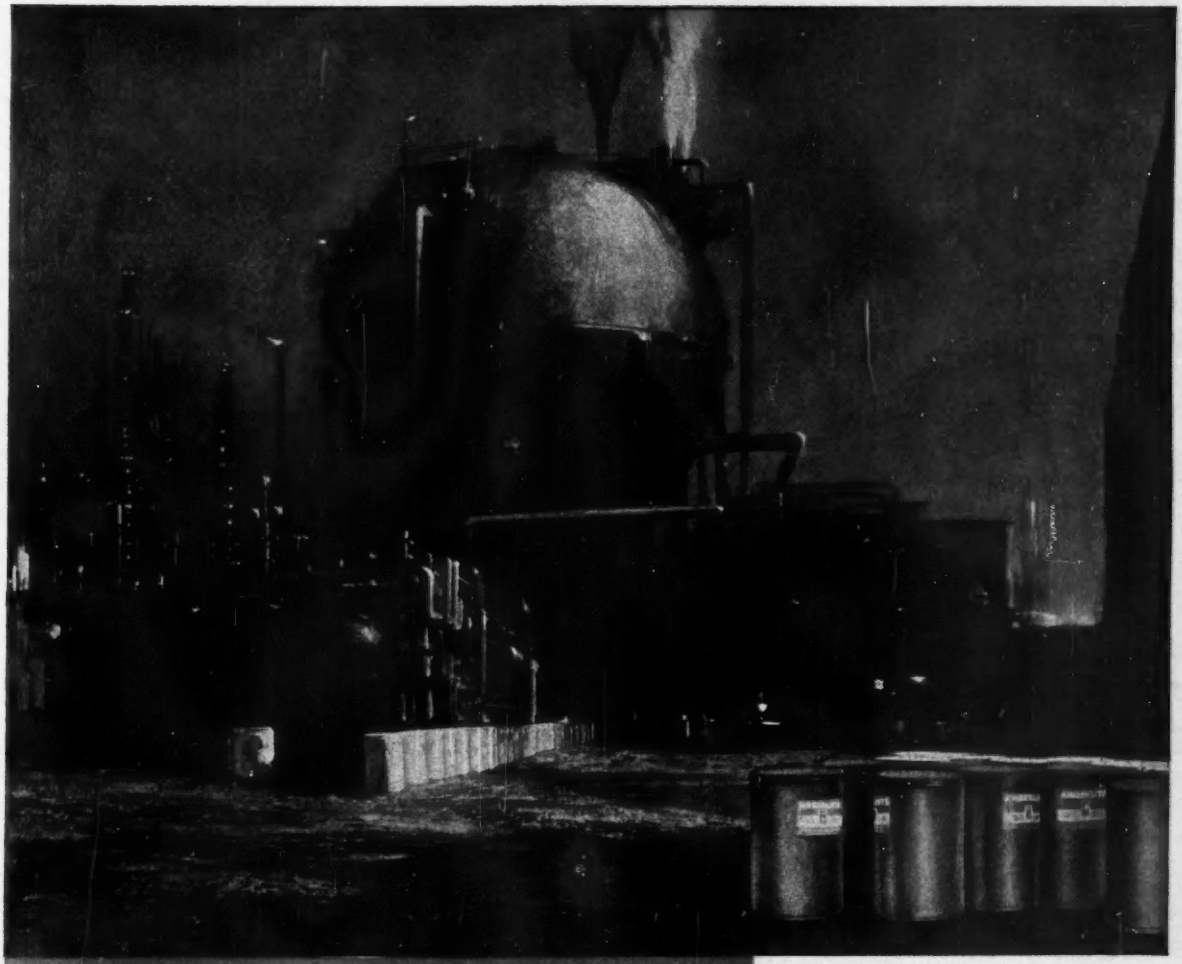
METHODS OF STRUCTURE DETERMINATION

THE DETERMINATION OF MOLECULAR STRUCTURE. By *P. J. Wheatley*, Clarendon Press, Oxford. 1959. Pp. 263. 35s.

As a teacher of physical chemistry to advanced classes, the reviewer has often wished for a moderately priced textbook which could be used in conjunction with a short course on physicochemical methods of structure determination. This little book provides one very satisfactory answer to the problem. It does not pretend to be inclusive, nor will it give satisfaction to those who like to see exacting mathematical derivations of basic equations, but for the advanced student in a crowded Honours year or for anyone wishing to obtain an overall critical view of modern methods of structure determination, it will prove quite invaluable.

The book is divided into three parts —Spectroscopic Methods, Diffraction Methods and Miscellaneous Methods. The second includes diffraction of electrons and of neutrons as well as of X-rays, while the third includes dielectric, magnetic and nuclear resonance techniques. Electron spin resonance is not included. Throughout the book the author has placed emphasis on the scope and limitation of the methods he describes and he provides many comparisons of the effectiveness and accuracy of different techniques by which similar information may be obtained.

R. C. PINK.



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Spectrophotometrical Stability of Metal Oxinates on Filter Paper

DIRECT spectrophotometric measurements of spots on paper has been recommended as an easy means of determining amounts of inorganic elements with great accuracy and reproducibility. Quantities as low as 0.03 microgramme of cobalt and copper, 0.02 microgramme of zinc have been determined within 30 minutes from the time the spotted solution has been sprayed on the filter paper using the reagent in order to produce the required colour for measurement.

It has been pointed out that for six elements (cobalt, copper, zinc, lead, barium and cadmium) when the spraying reagent is acetic oxyquinoline dissolved in acetone (150 mg. oxine, 0.5 ml. of conc. acetic % of acetone), standardised conditions can be recommended which are alike for all of these elements and lead to the possibility of their determination. Recently, the test has been successfully extended to determinations of strontium and calcium.

Oxyquinoleates

The oxyquinoleates, which in daylight are so much alike, have a different appearance under U.V. light on paper and fluoresce more or less according to the considered element; whereas the reagent itself does not fluoresce, and does not interfere consequently in the measurement of the oxyquinoleates themselves. Maximum absorption occurs for every one of these oxyquinoleates at 360μ and measurements follow, using a hydrogen lamp, a blue phototube and a slit 0.98 mm. wide with the Beckmann spectrophotometer. The procedure is simple. The spot on paper or the spotted solution of the element to be determined is dried at 40°C after being sprayed. It is then introduced in the cell containing redistilled water and a calibrated spacer made of transparent glass designed to keep the strip of paper flat in front of the cell window. Estimation is carried out immediately on a blank, on a reference spot and on the unknown.

The necessary time to achieve a number of such determinations is less than 30 minutes, all manipulations included.

As oxyquinoleates are known to be affected by different factors in their stability, the same determinations have been on the same paper strips after 15, 30, 45 and 60 minutes—this time being counted from the end of the spraying till the end of the determinations. Variations in percentage of optical density units are calculated on nine different experiments (strips) each time and are given in the following table to show the stability of these complexes under normal conditions.

Except for lead, reproducibility is very good even 45 minutes after the spraying has been done. Under working conditions, these oxyquinoleates can be considered as very stable during that period which largely overlaps the necessary time for the determinations. They can therefore be recommended for quantitative microanalytical purposes applicable to solutions or to chromatographic spots on paper.

Stability of Oxyquinoleates Time—Expressed in % of Optical Density Units

Element Involved in the Oxyquinoleate		Variations in % of Optical Density Units—Time in Minutes Between the End of Spraying and the End of Determinations				Means in O.D.U. for Individual Determinations
Name	quantity μg	15′	30′	45′	60′	
cobalt	0.5	0.03	0.03	0.03	0.14	0.241
copper	0.5	0.02	0.02	0.02	0.20	0.247
zinc	0.5	0.02	0.02	0.02	0.02	0.380
cadmium	3.0	0.09	0.08	0.11	0.11	0.080
lead	0.1	0.17	0.22	0.22	0.26	0.035
lead	3.0	0.10	0.08	0.15	0.08	0.075
barium	0.1	0.08	0.08	0.07	0.07	0.086
barium	3.0	0.04	0.05	0.04	0.05	0.164

Detergent Composition for Radioactive Contamination

U.K. Patent Application No. 10212/58 by D. G. Stevenson gives details of a detergent composition for removing radioactive metal contamination. The detergent composition comprises a synthetic surface active agent, a water-soluble polycarboxylic acid containing the group $-N(CH_2COON)_2$, another water soluble polycarboxylic acid and an alkali metal or ammonium base in amounts such that an aqueous solution of the detergent composition would have a pH in the range 3 to 9.

A detergent cream can be made, it is stated, by adding powdered sodium alginate to the solution.

Stevenson reports also that the action on contaminated cloth is improved by the presence of an alkali metal fluoride.

New Silicone Alloy for Water Repellency in Cotton Fabrics

NEW silicone alloy of tetravinyl silone (TVS) and methyl hydrogen siloxane (MHS), polymerised simultaneously, developed by the U.S. Department of Agriculture is stated to give excellent water repellency to cotton.

According to U.S.D.A. researcher, Charles J. Connor, reporting to the 8th Chemical Finishing Conference (*Chem. and Engng. News*, 1959, **37**, No. 43, 46), when TVS and MHS are polymerised separately, then mixed, the solution gives the same results as that coming from simultaneous polymerisation (hence the term silicone alloy). Benzoyl peroxide is used as catalyst and methyl isobutyl ketone as the solvent in polymerising the agent. Best results are claimed when using TVS and MHS in a 1 to 5 ratio. Addition of a zirconium catalyst (zirconyl acetate or zirconium butoxide) also helps.

Using the silicone alloy, fabrics get spray ratings of 100 before and after boiling in a soap-sodium carbonate solution (100 rating means best possible repelling power). Some silicones now used are reported to have lower ratings after boiling, with the fabrics left hard and uncomfortable to wear. Such disadvantages have not been noticed with the new silicone alloy.

Made into an aqueous emulsion using ethoxylated oleamide as emulsifier, TVS-MHS is reported to be easy to apply and if a trazone resin is dissolved in the alloy, treated cloth is found to resist creasing, in addition to water.

Other advantages claimed for the new silicone are low curing time and temperature and no discoloration of fabric.

U.S.D.A.'s southern research laboratory reports that by controlling the degree of fibre swelling at the time of cross-linking with formaldehyde, wrinkle-resistance of cotton cloth can be controlled. It has been found that a swollen cotton fibre remains swollen when its cellulose chains are cross-linked with formaldehyde and that a collapsed fibre stays collapsed when it is cross-linked.

The U.S.D.A. group point out that fibres swollen with water resist wrinkles if the fibres are wet, but if they are dry they do not resist even when large amounts of formaldehyde are added. Fibres constructed in a collapsed condition, however, can be line-dried, drip-dried and spin-dried. To accomplish this water was progressively replaced with a relatively non-swelling liquid—acetic acid—in the formaldehyde reactant. Cross-links fixed the fibres in the state of swelling that existed in them at the moment of cross-linking, it is reported. It was found that when the reacting solution contained 9% water, the very slightly swollen fibres resisted wrinkling equally well in both dry and wet state.

A possible mechanism suggested to explain the reason swollen fibres do not resist dry wrinkling when cross-linked is that water enters the region of the fibre where hydrogen bonds occur and disrupts this natural bonding of cellulose chains. When formaldehyde is added, it forms links where hydrogen bonding had existed. In a collapsed state hydrogen bonds remain, links form where they do most good and fibres then resist wrinkling whether wet or dry.

Applications for the Corday-Morgan Award

Applications for the annual Corday-Morgan Award, consisting of a silver medal and monetary prize of 200 guineas, should be made to the general secretary of the Chemical Society, Burlington House, London W.1, not later than 31 December 1960.

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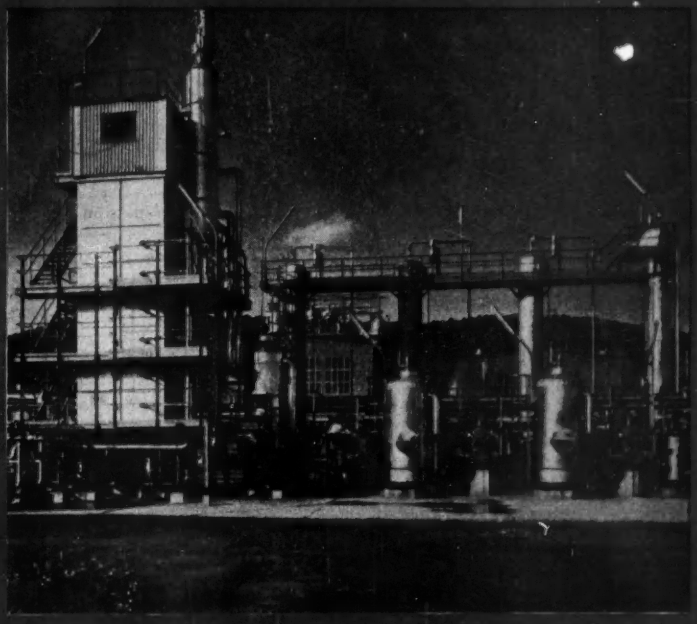

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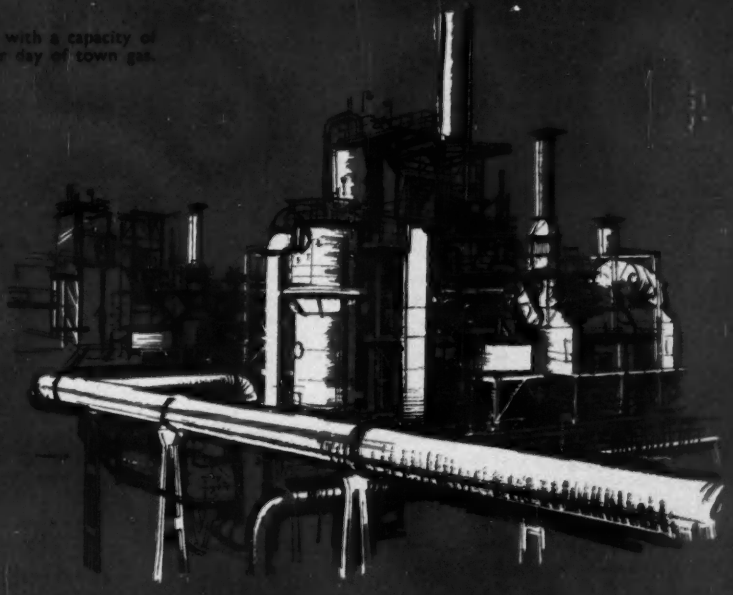

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Overseas News

AUSTRIAN ESTIMATES PUT 1959 CHEMICAL OUTPUT AT 1958 LEVELS

ESTIMATES put Austria's chemical production in 1959 at about the same level as the previous year. Outputs are expected to have followed generally the trend set up in the first half of the year, when inorganic and basic chemicals output rose by 6% over the same period of 1958, plastics production and processing by 23% and cellulose fibre by 8%. Tar-based production, however, fell by some 14%. Imports during the first half-year in the chemicals field rose in quantity by 4.1% and in value by 5.6%; chemical exports, although suffering a quantitative fall of 10.5%, rose in value by 4.3%.

Giving a picture of the future, with two trade blocs operating in Western Europe, the Austrian chemical industry points to the fact that in 1958 some 63% of its imports came from countries of the Common Market and only 14.5% from countries of the Outer Seven. Austrian chemical exports went 24% to Common Market and 8% to Outer Seven countries. Imports of Austria from the U.S. chemical industry last year were 6% and exports to the U.S. of Austrian chemicals 8%. Although the Iron Curtain countries accounted for only another 6% of Austria's chemical imports, nearly a third of all Austria's chemical exports went to these countries.

Reichhold to Increase Phenol Capacity in U.S.

Thirty million pounds per year of phenol capacity will be added by Reichhold Chemicals at their Tuscaloosa, Alabama, plant. Already under way the expansion will cost about $2.5 million, and will increase the company's capacity to 90 million lb. a year.

Current demand for phenol in the U.S. is stated to be good, and phenol plants have been operating at about 80% of capacity during 1959.

New Italian/U.S. Synthetic Fibre?

Reports from Trieste indicate that the Snia Viscosa fibre concern is planning, together with the U.S.-owned Food Machinery and Chemical Corporation, to produce a new synthetic fibre. A plant is stated to be planned for the fibre's manufacture, which, located in the industrial harbour area of Trieste, will cost some Lire 9,000 million, or about £50 million, to build.

Cofidal's Chemical Interests in Algeria

Cofidal (Cie Financière pour le Développement Economique de l'Algérie) report that they have participated in the formation of Compagnie Algérienne de Pétrochemie. A plant for the manufacture of nitrogenous fertilisers will be operated by Société Algérienne de l'Azote, Azotal, in which Cofidal are shareholders.

Laying of a pipeline to bring the natural gas from the Hassai R'Mel deposit in Algeria is planned to commence shortly, and production of 3,000 million cu. m. annually is finally envisaged. It is hoped that the gas may become the basis of an ammonia plant, and be used in production of fertilisers, petrochemicals and for electrolysis of chlorine products.

Du Pont to Set Up New Sulphuric Acid Plant

Sulphuric acid will be produced by E. I. du Pont de Nemours in Texas. A multi-million dollar plant will be set up at the company's Houston Works near La Rorte, Texas. Plant construction will begin immediately and completion is scheduled in about a year.

The new unit will supply sulphuric acid to Du Pont's caprolactum plant now under construction at Beaumont, Texas, and will provide an additional supply for sale in the Gulf Coast area. The unit will also reclaim sludge acid from alkylation units making high octane gasoline. First of Du Pont's sulphuric acid units in Texas, the new plant will be the company's eighth acid plant modernisation or expansion project since the end of World War II.

Dutch Chemical Output Rose by 5.5% in 1959

According to a Dutch Ministry of Economics statement issued this week, the country's chemical industry achieved in the first nine months of 1959 an overall production increase of 5.5% on the same period of the previous year and one of almost 8% over the 1957 period.

Higher U.S. Wholesalers' Stocks and Sales

According to a bulletin of the U.S. Department of Commerce, wholesale sales of drugs, chemicals and allied products in the U.S. in the first ten months of 1959 were higher by as much 12% than those for the same period of the previous year. By the end of the period stocks on hand in the case of wholesalers for these products were, as far as cost value was concerned, higher by 4% than those at the end of October 1958.

Pechiney-Saint Gobain Form Joint Company

Pechiney and Saint Gobain have formed a Frs. (new) 1 million company, called Produits Chimiques Pechiney-Saint Gobain, based on a 50-50 partnership. Agreement of these companies to pool their chemical activities was announced last October (CHEMICAL AGE, 31 October 1959, p. 616).

Pakistan Penicillin Factory to be Extended

Pakistan's present annual consumption of about 7 million mega-units of penicillin will be more than met by the new Government factory at Daudkhel, which has now gone into production and is scheduled to fabricate some 10 million mega-units a year.

This is based on a reportedly high yield during test runs, when the improved strain of fungus used, cultured in a suitable medium, produced results in excess of those initially envisaged. Expansion to 15 million mega-units of the antibiotic is planned for the future.

Italian Exports of Chemicals 23.2% Higher

During January to October 1959, Italian exports of chemicals were valued at Lire 111,515 million (about £65 million) or 23.2% more than in the same period of 1958.

Group results were: Explosives and inflammable compounds, 1,506 tons (compared with 1,873 tons); chemical fertilisers, 1,023,619 tons (690,166); pesticides, 12,518 tons (14,165); pharmaceutical chemicals, 2,904 tons (2,640); dyeing and tanning extracts, 13,690 tons (16,896); essential oils and essences, 540 tons (468); sulphur, raw, 27,620 tons (28,844); synthetic rubber, 20,987 tons (283); plastics materials and synthetic resins, 47,031 tons (33,281); other inorganic chemicals, 157,201 tons (164,641); other organic chemicals, 100,074 tons (76,730); miscellaneous chemicals, 370,034 tons (391,869).

Higher Yugoslav Output

Output of the Yugoslavian chemical industry in 1959 is reported to have increased by about 30% compared with 1958. Increase for the country's industry as a whole was 13%.

Ethylene from Israel

At the petrochemicals installations to be erected in the Negev area of Israel, some 3,000 tons of ethylene will be produced annually by the cracking of crude oil. Two-thirds of this ethylene will be used for the manufacture of ethylene dibromide for export and the remaining 1,000 tons will go to the plastics industry and for the production of intermediate products for the synthetic detergent industry. Cost of the petrochemicals plant, which will produce kerosene, gasoline, fuel oil and domestic gas as by-products, is given as £110 million.

Investments Granted for Chemical Projects in Argentina

Among the investments from foreign industrial concerns granted last week by the Argentine Government were sums of £1,500,000 from Imperial Chemical Industries Ltd. for chemicals, acids and hydrogen peroxide, U.S.$13 million from Solá, of Geneva, for sodium alkali and derivatives, U.S.$625,000 from Ciba S.A., Basle, for textile auxiliary chemi-

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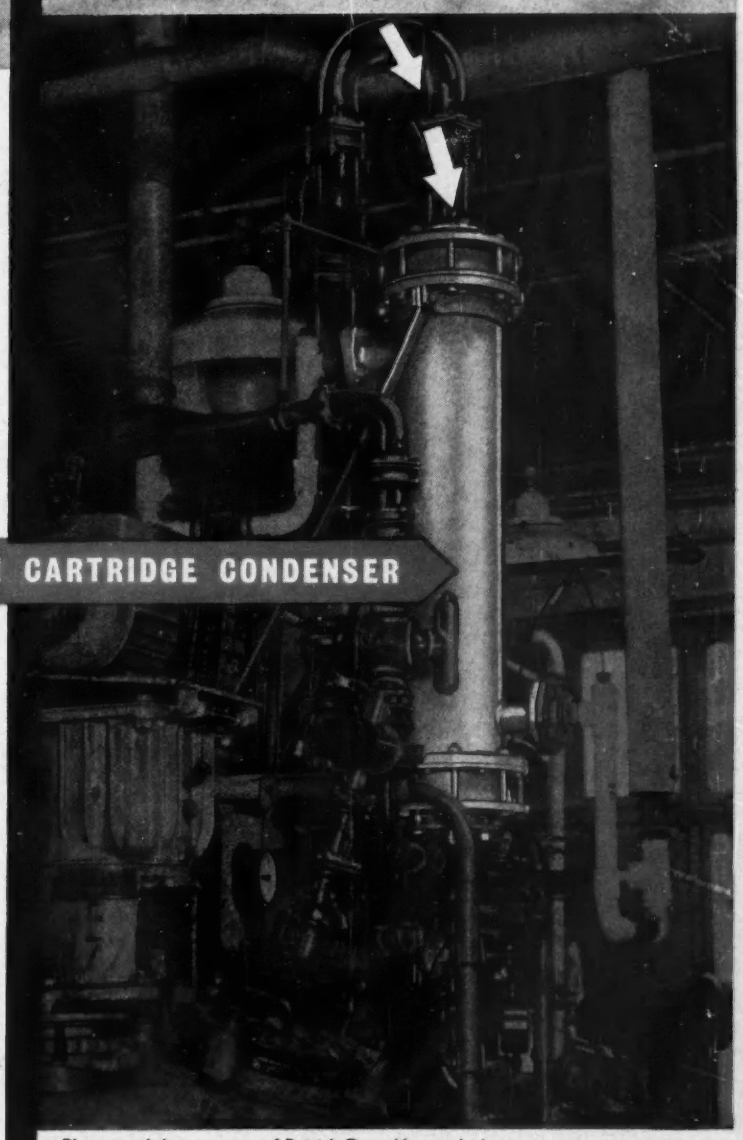

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cals, and DM.215,000 from the E. Merck concern of Darmstadt, West Germany, for the expansion of its Argentine subsidiary.

Federal German Potash Cartel Announced

The Federal German Cartel Office has given its permission to the formation of a cartel by the country's potash producers. The cartel, drawn up by the Association of German Potash Producers, covers the sale of all potassium salts produced in West Germany through a central body, Verkaufsgemeinschaft Deutscher Kaliwerke GmbH, based in Hanover. The cartel is valid until 31 December, 1962.

German-Hungary Chemicals Trade Pact

Under the 1960 trade pact between West Germany and Hungary, in which value of goods has increased 35% in either direction, Federal Germany is to supply Hungary with chemical products and synthetic fibres as two of the main items on the pact programme.

Japanese Get Butadiene by Tanker from U.S.

To get their 45,000 metric-ton-a-year synthetic rubber plant on stream at Yokkaichi, the new Japanese company, Japan Synthetic Rubber, are dependent on a specially equipped tanker, the *Agipgas Terza*. The company is buying butadiene from California Chemical International (subsidiary of Standard Oil of California) until it can complete its own butadiene operation. The first shipment was expected to reach its destination by 27 December.

The *Agipgas Terza* is owned by an Italian company, Societa Nazionale, Metanodotti, who lease the tanker to California Chemical. The butadiene is carried in 18 cylindrical steel tanks, each 27 ft. deep. The tanker's total capacity is 900 tons of liquefied gas.

Originally designed to carry liquid propane, the *Agipgas Terza's* tanks and loading gear—lines, compressors and pumps—are stated to be capable of handling up to 250 p.s.i. As liquid butadiene has a considerably lower vapour pressure, no problems were encountered; in fact, the highest pressure met with during loading was 60 p.s.i.

Trucks normally carrying liquefied petroleum gas carried the butadiene from Standard's Torrance refinery to the loading terminal at San Pedro.

New Fibre from Du Pont de Nemours

A new type of chemical fibre is announced by the U.S. producer Du Pont de Nemours. The fibre, known as Orlon Type 39 is said to act against static charging and improved processing and utilisation qualities. Orlon Type 39 was developed particularly for the wool spinning industry.

Celanese Plastics to Increase Polythene Capacity

Celanese Plastics Co. are to increase production at their high density low-pressure polythene at Houston, Texas, to 50 million lb. a year capacity—an increase of 10 million lb. a year.

The Texas plant, which has been on stream since March 1957, was the first full-scale U.S. plant to make low-pressure polythene. The new expansion is expected to be completed by March this year.

New Rumanian Polyester Fibre

Research workers at the Icechim Institute, Rumania, are reported to have recently devised a method of manufacture of a new polyester fibre. It is stated that the new synthetic fibre is a good substitute for wool and is obtained by chemical processing of crude oil. Resistance to stretch and atmosphere, and also to elasticity are among characteristics of the new fibre. It is proposed to use the new polyester fibre in the manufacture of cloth, light fabrics and curtains, etc.

Louisiana Refinery Increases Butyl Rubber Plant

Capacity for butyl rubber production of the Esso Standard Oil Baton Rouge, Louisiana, refinery will be increased by 38,000 long tons annually. Present capacity is 40,000 long tons. Of the plant's extra capacity 20,000 long tons will become available in June 1960, and the remainder in 1961.

W. German Orders For France

Orders for four plants for the drying of natural gas have been received from France by the Butzbach, West Germany, construction company to the chemical industry, Pintsch Bamag AG. The installations are for the Lacq gasfields in south-western France.

U.S. Chemical Spending

Statistics issued this month by the U.S. Office of Business Economics in Washington show that in the first quarter of 1960 the U.S. chemicals and allied products manufacturing industry is expected to spend some $1,420 million on new plant and equipment. The associated petroleum and coal products industry will invest an anticipated $2,530 million over the three-month period. These correspond to investments by the two industrial branches—chemicals and petroleum-and-coal-products — respectively of $1,300 million and 2,540 million in the fourth quarter of 1959, $1,140 million and $2,530 million in the first quarter of the year and $1,510 million and $2,860 million in the first quarter of 1958.

Argentina to Erect New Chemical Plants

According to official announcements Industrias Quimicas Duperial are to erect a plant costing 580 m. pesos (some £2.5 million) 'for the production of chemicals' in San Lorenzo.

In the south of the country, in the Province of Chubut, representatives of the firm of Prenyl have put forward a proposal for installation of a nylon production plant, representing an investment of $1.6 million (U.S.).

Brazilian Plant to Increase Hydrogen Peroxide Output

A loan of 20 million cruzeiros (some £35,000) has been granted by a Brazilian national bank to the firm of Industria Quimica da Mantiqueira S.A. to enable it to increase annual output of hydrogen peroxide to 850 tons. This is expected to save the country some $200,000 (U.S.) per annum in foreign exchange.

Mexican Sulphur Exports

Chemical fertiliser to the amount of 121,718 tons, worth 125,200,000 pesos, or £3,577,150 approximately, was imported by Mexico during the period January-August 1959 (112,519 tons). Imports of organic and chemical mixtures totalled 17,851 tons valued at 166,700,000 pesos, or £4,762,900 (18,180 tons).

During the above period the country exported sulphur totalling 807,490 tons worth 222,600,000 pesos, or £6,360,000 (662,907 tons).

E.N.I. Plan 1-million-ton Fertiliser Capacity

REFINERIES connected with the E.N.I. Group processed almost 5,700 tons of raw materials during the past year, including considerable quantities of crude from the Egyptian fields. Crude was also processed from the Gela field, which has replaced Venezuelan crude in bitumen production, apparently with satisfactory results; and preparations have been made for refining abroad.

In Switzerland *Raffineries de Rhône*, a third of whose capital is held by the Group, will construct a 2-million-ton refinery at Aigle which will be supplied through the pipeline from Genoa.

Installations for production of nitrogenous fertiliser and synthetic rubber have gone on stream at the A.N.I.C. petrochemical works at Ravenna, reaching scheduled production capacity; and production has also begun at the calcium nitrate installations. In addition, work has gone ahead on plant for butadiene production from butane, and urea; and on completion will raise annual capacity of fertilisers to 1 million tons and that of rubber to 70,000 tons.

Plans have been laid before the Government for a projected factory for on-the-spot cracking of crude from Gela at the rate of some 3 million tons/year, yielding petroleum coke and liquid hydrocarbons in addition to gas. It is planned that the coke would feed a thermal power station, the liquid fraction would be refined and the gaseous fraction constitute the feedstock for petrochemicals.

From the Egyptian deposits of *Compagnie Orientale des Petroles d'Egypte* nearly 1.9 million tons of crude were extracted during the past year. During the first four months of the year natural gas production totalled some 66,000 million cu. ft., and output of liquid and liquefiable hydrocarbons some 113,000 tons.

Detailed technical booklets and information available on request

Laporte Chemicals Ltd., Luton. Telephone: Luton 4390

PEOPLE in the news

● Each of the partners in the Nuclear Power Group (see page 79) will have three representatives on the board: the A.E.I.-John Thompson Nuclear Energy Co. Ltd. will be represented by **Viscount Chandos**, who is chairman; and by **Sir Edward Thompson** and **Mr. H. West.** Representing the Nuclear Power Plant Co. Ltd. will be **Mr. R. Edwin McAlpine** (vice-chairman); **Mr. H. H. Mullens** and **Sir John G. Wrightson, Bt.**, together with **Mr. A. J. Sayers** (general manager). The senior executives of the N.P.G. will be: **Mr. S. A. Ghalib**, deputy general manager; **Mr. W. A. K. Wicks**, secretary; **Mr. R. D. Vaughan**, chief engineer; and **Mr. J. R. M. Southwood**, deputy chief engineer.

● **Mr. Wilfred F. Dines** has joined the board of Midland Tar Distillers Ltd. He was responsible for the design and erection of the company's refinery at Four Ashes in 1949/51, and has been its manager since it came into operation.

● **Mr. G. V. K. Burton**, a director of Fisons Ltd., becomes chairman of the new Fisons Horticulture Ltd. (see page 79). General manager is **Mr. F. J. Heath**, and other directors are: **Dr. J. G. Hunter, Mr. P. M. Packard** and **Mr. K. J. S. Vasey.** Now that all trading activities of the group have been

Mr. C. V. K. Burton **Mr. C. E. Horton**

transferred to subsidiaries, the executive functions of the parent board will be exercised through two managing directors, **Mr. J. W. Napier** and **Mr. A. Wormald. Sir Ian Jacobs, K.B.E., C.B.,** has also joined the board. (**Mr. C. E. Horton's** appointment as vice-chairman of Fisons Ltd. was announced in CHEMICAL AGE, 26 December, 1959.)

Left to right are Mrs. Pashley, Mr. A. H. Pashley, director and general manager, and the chairman of Wilfen and Sons Ltd., Mr. A. Robinson, on the occasion of a presentation to Mr. Pashley to mark forty years of unbroken service with the company. The gift was a 35 m.m. projector from Fisons Ltd., the parent company

● **Mr. B. A. Worswick, B.Sc. (Hons), A.Inst.P.**, has been appointed to the post of technical director of Elcontrol Ltd., industrial electronic engineers, with a seat on the board. He was until recently chief engineer of Fischer and Porter Ltd., and previously served for some years with the I.C.I.

● **Mr. A. J. W. Green,** who was elected to the main board following the Braby/Auto Diesels merger, has been appointed joint managing director for the Frederick Braby Group.

● **Dr. Bernard Raistrick, B.Sc., Ph.D., M.I.Chem.E., F.R.S.E.**, director and research manager of Scottish Agricultural Industries Ltd., has been appointed to a full-time executive directorship of the Associated Chemical Companies Ltd.,

Dr. Raistrick, who has been appointed to a directorship of A.C.C. Ltd.

with particular responsibility for scientific matters. He will assume the new post on 1 April 1960. He is a former president of the Fertiliser Society.

● **Mr. Mark Gardner** has retired as sales director of Erinoid Ltd.

● **Mr. M. A. E. Hodgson** has been appointed development director of the Heavy Organic Chemicals Division, I.C.I., with effect from 1 February 1960. **Mr. R. Haslam** has been appointed personnel director of the Nobel Division with effect from 1 February in succession to **Dr. A. C. Richardson** who is retiring from the company's service on the 31 January. **Mr. C. G. Harris,** General Chemicals Division research director, retired on 31 December. He joined Synthetic Ammonia and Nitrates Ltd. in 1929, and in 1931 joined General Chemicals Division, being appointed research manager of that division in 1951 and research director in 1953.

● **Mr. H. Kerr** has resigned from the board of the Woodall-Duckham Construction Co. on retirement.

● **Mr. E. M. Padgett** has resigned from the board of the Bradford Dyers' Association owing to ill-health.

● **Mr. Theo F. C. Mills,** a chemicals consumer sales representative, is travelling some 20,000 miles in the Far East representing the Chemicals Division export department of Newton Chambers and Co. Ltd., Thorncliffe, Sheffield.

● **Mr. Philip Colebrook,** managing director of Pfizer Ltd., manufacturing chemists of Sandwich and Folkestone, has also been appointed managing director of Kemball, Bishop and Co. Ltd. fine chemical manufacturers. Mr. Colebrook succeeds **Mr. W. W. Muir** and **Mr. R. F. Kemball** joint managing directors of Kemball, Bishop. Mr. Muir is remaining on the board in an advisory capacity. **Mr. John Platt** has been appointed general works manager of Kemball, Bishop. He was formerly a planning executive of Pfizer Ltd. A Yorkshire man with long experience in the chemical industry, he is a graduate of London University.

Mr. P. Colebrook, appointed managing director of Kemball, Bishop and Co. Ltd.

● **Mr. P. E. Matthews,** a technical representative of William Boby and Co. Ltd., water treatment engineers of Rickmansworth, Herts, leaves for Australia with his wife on 12 January, and will remain there some six months. (See page 105.)

● **Dr. Wallace R. Brode,** science adviser to U.S. Secretary of State, Christian A. Herter, has won the American Chemical Society's 1960 Priestley Medal—the highest honour in American chemistry. He was for 20 years professor of chemistry at the Ohio State University.

● **Sir Cyril Hinshelwood,** president of the Royal Society, has appointed the following vice-presidents for the year ending 30 November 1960: **Sir William Penney, K.B.E.,** R.S. treasurer, member for scientific research, Atomic Energy Authority; **Sir Lindor Brown, C.B.E.,** R.S. biological secretary, Jodrell professor of physiology, University College London; **Sir William Hodge,** R.S.

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physical secretary, Lowndean professor of astronomy and geometry, Cambridge University; **Dr. H. G. Thornton,** R.S. foreign secretary, lately head of the department of soil microbiology, Rothamsted Experimental Station; **Sir Patrick Linstead, C.B.E.,** rector of the Imperial College; **Professor Wilson Smith,** professor of bacteriology at University College Hospital Medical School, London.

● **Dr. Maurice Cook, Ph.D., D.Sc.,** who has been chairman of I.C.I. Metals Division for the past two years, retired from the company's service on 31 December. He is succeeded by **Mr. Michael Clapham,** a joint managing director. Dr. Cook joined the Research

Michael Clapham, who succeeds Dr. Cook as I.C.I. Metals Division chairman

Department of Kynoch Ltd. in 1926. He became joint managing director of Metals Division in 1951 and chairman in 1957. Until his retirement he was a director of Yorkshire Imperial Metals Ltd.

● **Dr. John A. Wheeler,** noted nuclear physicist and a professor at Princeton University, has accepted an appointment to the board of trustees of Battelle Memorial Institute. As a Guggenheim Fellow, he conducted studies in Paris and Copenhagen in 1949 and 1950. He was a National Research Fellow from 1933 to 1935, studying at New York University and Copenhagen.

● **Sir Leonard C. Paton, C.B.E., M.C.,** chairman of the Durham Chemical Group, presiding at a recent works social function, presented awards for 25 years' service with the company to the following employees: **Mr. O. Dodds; Mr. H. Hammill; Mr. J. Barker; Mr. H. Lewis; Mr. W. Waggott.**

● **Dr. Hugh Clarke, O.B.E., D.Sc.,** a part-time executive director of Associated Chemical Companies Ltd., will retire on 31 March 1960.

● **Mr. G. A. D. Smith** has been appointed commercial managing director of I.C.I. Metals Division. He joined the division in 1936 and three years later

G. A. D. Smith, new commercial managing director, I.C.I. Metals Division

was appointed head of the group formed to develop propellant cartridges for the well-known Blacker Bombard and P.I.A.T. weapons. Appointed to the board of I.C.I. Metals Division in 1951, Mr. Smith has since served as sales director and commercial director.

● **Mr. D. H. Cutler** has been appointed commercial manager of the Laporte Group of Companies, and has relinquished his appointment as commercial manager of Laporte Chemicals Ltd. Three directors of Laporte Chemicals have taken up appointments as follows: **Mr. W. S. Wood** as technical manager, **Mr. E. C. Rounsefell** as commercial manager, and **Mr. B. H. Oldfield** as engineering manager. In addition the following management appointments have been made by Laporte Chemicals: **Mr. R. E. Northam** as works manager, Luton, **Mr. G. F. Sommerville** as works manager, Warrington, **Mr. W. R. Holmes** as research and chemical development manager, and **Mr. P. E. Watson** as personnel manager.

● **Dr. A. J. Amor,** I.C.I. principal medical officer for the past thirteen years, retired on 31 December 1959. He joined the I.C.I. Metals Division in 1935 and served as medical officer at the Swansea works. He was awarded the C.B.E. in 1950. Dr. Amor is succeeded by **Dr. A. Lloyd Potter,** who since 1946 has been medical officer of I.C.I. General Chemicals Division in Cheshire.

● **Mr. R. M. Dickson,** who has been the Scottish Area director of Boots the Chemists for the past seven years, has been appointed London director and Southern Area director for the company with effect from 1 January. He will be succeeded as Scottish Area director by **Mr. Henry J. Fraser,** who also becomes a director of Boots Cash Chemists (Northern) Ltd.

● **Mr. W. H. Ritchie** has been appointed as development manager—projects, and **Mr. N. G. H. Thomas** as development manager—products, with effect from 1 January, by Monsanto Chemicals Ltd. Both will be responsible to **Dr. J. A. Gardner,** controller of development. Mr. Ritchie, who joined Monsanto in 1937, will be responsible for progressing the manufacture of new products, and for development planning. Mr. Thomas, who joined Monsanto in 1946, will be responsible for the development and introductory marketing of new products, and for market research.

● **Dr. Albert L. Elder,** director of research of the Corn Products Co., Argo, Ill, recently took office as president of the American Chemical Society. He succeeds **Dr. John C. Bailar Jr.,** professor of inorganic chemistry at the University of Illinois, and will serve for one year.

● **Mr. E. P. Danger** has resigned as a director of Kemp's Bureau of Trade Research, and will operate in future as a specialist in industrial market research.

● In view of the extension of the technical service department of CIBA Clayton Ltd., Manchester 11, by the opening of new laboratories, the board has appointed **Dr. J. K. Skelly, Ph.D., F.S.D.C., A.R.I.C.,** a senior lecturer at Belfast University, to be an additional deputy chief colourist from 1 January.

● The wedding took place recently of **Dr. Robert Bruce Watson,** of Burnley, Lancashire, and Miss Mary Doris Barclay, only daughter of the Rev. and Mrs. R. A. Barclay, of Leeds. The bridegroom is lecturer in organic chemistry at Leeds College of Technology.

● **Mr. W. J. Rennie,** director and secretary of Allen and Hanburys Ltd., has retired from the company. He is succeeded as secretary by **Mr. L. M. Bennett.**

● **Mr. J. B. Crossley,** who was appointed commercial director of the I.C.I. Plastics Division in 1952 and subsequently became home sales director in 1957, retired on 31 December last. Mr. Crossley, an extremely well-known figure in the plastics industry, was chairman of the Plastics Institute during 1957-59. He is a member of the Council of the British Plastics Federation and chairman of its publicity committee.

Obituary

Mr. Mark Douglas, managing director of Morgan Refractories Ltd., Neston, died suddenly on 27 December, aged 59. He started his career as a chemist in a research laboratory and served in the Steepley Group before joining the Morgan Crucible Co., parent company of Morgan Refractories, and went to Neston as works director in 1954, being appointed managing director two years later.

Will

Mr. Ernest Pedley, director of the North-West Forsenic Science Laboratory at Preston, who died on 16 July last, intestate, left £9,246 net.

Prime Minister to Attend Metals Institute Dinner

The Prime Minister, the Rt. Hon. Harold Macmillan, M.P., has accepted an invitation to be principal guest and speaker at the annual dinner of the Institute of Metals, which is to be held in Grosvenor House, London W.1, on 31 March. The U.S. Ambassador will reply to the toast.

C.A. Index to Volume 80

Index to 'Chemical Age' Volume 80 (July to December, 1958), containing over 6,000 individual references has now been published, following delays due to the printing dispute of last summer, and will be despatched shortly. Price is 5s. per copy, including postage. Readers who have not already reserved a copy should write to the Manager, 'Chemical Age', 154 Fleet Street, London, E.C.4, as soon as possible

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NEW PATENTS

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Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 24 February

Production of aqueous uranyl sulphate solution from uranium dross. Spiegler, L. **829 087**

Separation of uranium peroxide from mixtures. Spiegler, L. **829 088**

Production of aqueous uranium sulphate solutions. Smith, S. B. **829 090**

Production of uranium and uranyl sulphate. Spiegler, L. **829 091**

Carbonates of covalent uranium and alkali metals or ammonium. Spiegler, L. **829 092**

Recovery of uranium by precipitation as peroxide. Spiegler, L. **829 093**

Production of uranium peroxide. Spiegler, L. **829 094**

Coating of uranium metal and uranium-base alloy. Huddle, R. A. U., and Gibson, A. R. **828 789**

Production of rubber-polymer mixtures and compounds. British Rubber Producers' Research Assoc. [Cognate application 27 142/59.] **828 895**

Polymerisation. Imperial Chemical Industries Ltd. **828 894**

Production of foam rubber. Dunlop Rubber Co. Ltd. **828 899**

Polymerisation of ethylene. Distillers Co. Ltd. **829 098**

Fertilisers. Arnold, J. C. (Facerform Co.). **828 881**

Selectively polymerising α-olefins. Montecatini Soc. **828 791**

Antifungal antibiotic designated NC 1968. Wooldridge, W. E. **828 792**

Anaesthetic compositions comprising, 2, 2, 2-trifluoroethyl vinyl ether and processes for producing same. Air Reduction C. Inc. [Addition to 742 083.] **829 010**

Purification of olefin polymers. Du Pont de Nemours & Co., E. I. **828 690**

Manufacture of polyethylene of high molecular weight. Farbwerke Hoechst AG. **828 692**

Process of shaped articles composed of high-melting polymers containing ester groups in the chain. Farbwerke Hoechst AG. **828 903**

Process for the emulsion polymerisation of vinyl esters. Wacker-Chemie GmbH. **828 693**

α-Amino-β-hydroxycarboxylic acid amides and a process for their manufacture. Farbwerke Hoechst AG. **828 694**

N-*p*-hydroxylphenyl amides with choleretic action. Farmaceutici Italia S.A. **828 695**

Fungicidal compositions. Poudreries Reunies de Belgique S.A. **828 904**

Process for producing phosphatic fertilisers Lummus Co. **828 891**

Manufacturing the dioxide of thiourea. Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey S.A. Des **828 907**

Method for splitting of fats in autoclaves at high pressures. Schlenker, E. **828 908**

Combined process for distilling and cracking hydrocarbon oils. Farbwerke Hoechst AG. **829 105**

Disazo dyestuffs and their use. Geigy AG., J. R. **828 698**

Antioxidant compositions. Ethyl Corp. **828 910**

Purification and separation of tetracycline. Olin Mathieson Chemical Corp. **828 911**

Cellulosic material. Johnson & Johnson. **828 913**

Manufacture of acrylonitrile. Wacker-Chemie GmbH. **829 106**

Production of titanium and similar metals. Union Carbide Corp. **829 108**

Formation of phosphate coatings. Pyrene Co. Ltd. **828 916**

Resinous compositions. American Cyanamid Co. **828 797**

Methods of chromising metals and alloys. Chromalloy Corp. **828 700**

Rust-inhibiting compositions and lubricants containing the same. Monsanto Chemical Co. **828 701**

Dry, solid penicillin compositions. Imperial Chemical Industries Ltd. **828 702**

Amides of 4, 4-bis(hydroxyphenyl)-pentanoic acids and their use in synthetic resin compositions. Johnson & Son Inc., S. C. **828 703**

Polyesteramides. Kodak Ltd. **829 011**

Preparation of dimethyl-terephthalate. Mid-Century Corporation. **828 919**

Vat dyestuff of the indigoid series and process for the manufacture thereof. Farbwerke Hoechst AG. **828 704**

Process for fermentative manufacture of combined agricultural vitamin B_{12} antibiotic preparations. Belik, F., Doskocil, J., and Herold, M. **828 921**

Bonding, coating and impregnating process. Imperial Chemical Industries Ltd. **828 922**

Retort gas producers. Heurtey & Cie. **828 923**

High linear polyesters. British Celanese Ltd. **828 706**

Manufacture of high linear polyesters. British Celanese Ltd. **828 707**

Production of acrylonitrile. Lonza Electric & Chemical Works Ltd. **828 710**

Purified sarkomycin, its derivatives and a method for preparing them. Takeda Pharmaceutical Industries Ltd. **828 807**

Dyeing polyester fibres. Farbwerke Hoechst AG. **828 924**

Ferromagnetic chromium oxide materials. Du Pont de Nemours & Co., E. I. **829 007**

Light stabiliser mixture. Monsanto Chemical Co. **828 712**

Supplying heat to molten metals. South African Iron & Steel Industrial Corp. Ltd. **829 120**

Polymerising conjugated 1.3-dienes. Monsanto Chemical Co. **828 803**

Oxidation processes. Imperial Chemical Industries Ltd. **828 812**

Elastomeric addition products. Goodyear Tire & Rubber Co. **828 814**

Control of polymerisation processes. Esso Research & Engineering Co. **828 926**

Stable, curable polyurethane compositions and method of making same. General Tire & Rubber Co. **828 718**

Metallised azo dyestuff of the benzene-azo-pyrazolone series. Fairweather, H. G. C. (General Aniline & Film Corporation). **829 125**

Preparing a dispersion of fluorocarbon resin for painting and the said dispersion obtained thereby. Asaka Kinzoku Kogyo Co. Ltd. **828 719**

Rigid polyvinyl halide composition. General Tire & Rubber Co. **828 721**

Low temperature sulphonation process. Esso Research & Engineering Co. **828 821**

Textile finishes. Celanese Corp of America. **828 822**

Tropane derivatives. Licencia Talalmanyokat Ertekesito-Vallalat. **829 015**

Olefin polymers and methods and catalyst for production thereof. Phillips Petroleum Co. **829 127**

Metallisable polyazo dyestuffs and their use. Geigy AG., J. R. **828 826**

Making solid disproportionated silicon monoxide. Goodrich Co., B. F. **828 723**

Polymerisation of alpha-olefins. Dow Chemical Co. **828 828**

Catalytic polymerisation of olefins and products thereof. Phillips Petroleum Co. **828 830**

Resinous organopolysiloxane compositions. Imperial Chemical Industries Ltd. **828 833**

Manufacture of a 1:3:5-triazine compound. Ciba Ltd. [Addition to 825 079.] **828 836**

Resolution of mixture by crystallisation. Phillips Petroleum Co. **828 837**

Separation of butadiene from hydrocarbons by extractive distillation. Phillips Petroleum Co. **829 021**

Elegant tetracycline pharmaceutical preparations. American Cyanamid Co. **828 726**

Method of coating a surface with poly-per-halocarbon resin and article formed thereby. Welch, P. R. **829 023**

Method of producing silicones. Kali-Chemie A.G. **828 843**

Production of active oxides of large specific surface area. National Research Council. **828 728**

Cyanide dyes. Ilford Ltd. **828 847**

Therapeutic compositions containing novobiocin. Pfizer & Co. Inc., C. **828 729**

Process for preparing ω-amino-alkane-nitriles Stamicarbon NV. **828 850**

Preparation of cyanoformamide. American Cyanamid Co. **829 029**

Mono azo triazine dyestuffs. Imperial Chemical Industries Ltd. [Addition to 785 222.] **829 042**

Instruments for analysing mixtures of gases and vapours. Gas Chromatography Ltd. **829 041**

9-Aminodecahydronaphthalene derivatives. Imperial Chemical Industries Ltd. **828 933**

Catalytic reforming of non-aromatic hydrocarbons. British Petroleum Co. Ltd., Moy, J. A E., White, P. T., and Burbidge, B. W. [Cognate application 17 382.] **828 934**

Crystalline zeolite Z and method for preparing same. Union Carbide Corp. **828 936**

Manufacture of chlorinated polyethylene. Farbwerke Hoechst AG. **828 938**

Removal of condensible impurities from gases Stamicarbon NV. [Addition to 799 351.] **829 135**

Jet fuel compositions. Ethyl Corp. **828 941**

Production of artificial threads by dry spinning. Courtaulds Ltd. **829 136**

Synthetic process for producing glutamic acid from acrylonitrile. Ajiomoto Co. **828 946**

Penicillin salts. Imperial Chemical Industries Ltd. **828 642**

Latex sponge rubber. United States Rubber Co. **828 643**

Lubrication of hydrophobic filaments. Imperial Chemical Industries Ltd. **828 735**

Fungicidal compounds. Philips Gloeilampenfabrieken NV. **829 142**

Polymerisation process. Esso Research & Engineering Co. **828 953**

Method of making cellular polyethylene. British Insulated Callender's Cables Ltd. **828 739**

Process for purifying chlorine. Farbenfabrieken Bayer AG. **828 644**

Fractional distillation tower. Esso Research & Engineering Co. **828 955**

Acetylene solvent. British Oxygen Co. Ltd. **828 741**

Lubrication composition. Texaco Development Corp. **828 956**

Copolymer emulsions. British Oxygen Co. Ltd. **828 957**

Polyolefin plastics. United States Rubber Co. **829 148**

Manufacture of polymeric materials. Imperial Chemical Industries Ltd. [Addition to 779 557.] **829 149**

Production of a polyvitamin preparation. Laboratoires Francais de Chimiotherapie. **828 960**

Herbicidal compositions. Shell Research Ltd. **828 871**

Preparation of substituted phenanthridine compounds. Boots Pure Drug Co. Ltd. [Addition to 816 236.] **828 962**

Polymerisation of ethylene, propylene, mixtures thereof, or mixtures containing either or both with other polymerisable materials. Standard Oil Co. [Addition to 753 350.] **829 150**

Preparation of organic phosphorus compounds. Metal & Thermit Corp. **828 746**

Fibres from thermoplastic materials such as glass. Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey S.A., Des. [Addition to 788 491.] **828 648**

Apparatus and process for pelleting thermoplastic materials. Canadian Industries Ltd. **829 152**

Pharmaceutical compositions containing 2-*p*-aminobenzenesulphonamido-5-*t*-butylol, 3, 4-thiadiazole. Soc. des Usines Chimiques Rhone-Poulenc. **828 963**

Tertiary-alkyl ferrocenes. Imperial Chemical Industries Ltd. **828 965**

Recovery of pure olefin polymers. Badische Anilin- & Soda-Fabrik AG. **828 650**

Polymerisation of olefins. Badische Anilin- & Soda-Fabrik AG. **828 653**

Gas/liquid contacting columns. Bataafsche Petroleum Maatschappij N.V., De. **828 655**

Arrangement for releasable connection of a vacuum vessel to a vacuum pump. Zeiss-Stiftung, C. [trading as Zeiss, C. (Firm of)]. **828 656**

Production of ethyl acrylate. Distillers Co. Ltd. **828 658**

Cathode diaphragm structures for electrolytic cells. Diamond Alkali Co. **828 659**

Film forming solutions of copolymers of N-vinyl pyrrolidone and N-vinyl esters. General Aniline & Film Corp. **828 970**

Polymerisation of ethylenically unsaturated hydrocarbons. Hercules Powder Co. **828 973**

Process for hydrogenation of unsaturated fatty acids and esters thereof. Unilever Ltd. **828 661**

Trimethylolphenol-polyol thermosetting copolymers. Union Carbide Corp. **828 662**

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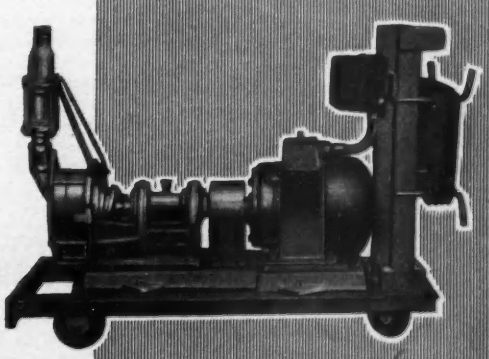

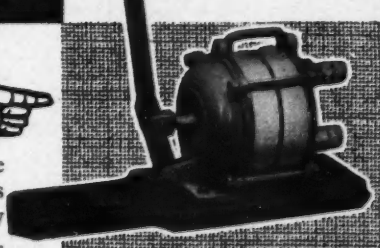

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Commercial News

- **Cooper, McDougall Profit is Doubled**
- **Fisons' C. & B. Offer is 'Most Favourable'**
- **Firth Cleveland to Acquire Solartron**
- **Allied Chemical Take-over S. African Firm**

Cooper, McDougall

Cooper McDougall and Robertson (Wellcome Foundation) accounts cover eight months for parent and 11 months for overseas subsidiaries, to 31 August 1959. Consolidated profit was £236,099, compared with a total £165,246 for year. Retained by subsidiaries was £58,104 (£1,312). Net profit of the parent company was £71,532 (£95,609). No dividend is declared (10%, plus 2½% capital distribution). Profit for the period of £236,099 includes income from associated companies £10,761 (£44,081), and after deducting depreciation of £130,631 (£148,123). Argentine subsidiary company showed a net profit for 11 months of Pesos 7,060,557 (loss Pesos 8,423).

Fisons and C. & B.

Having been advised throughout by Robert Benson Lonsdale and Co., and after considering all relevant factors, the directors of Crosse and Blackwell Holdings say they have "no hesitation" in stating that the offer of 82s per £1 ordinary share from Fisons Ltd., is "most favourable." The other bid by Nestlé of Switzerland was 72s cash per share for the £2.7 million ordinary capital.

Crosse and Blackwell's group profits, before tax, which amounted to £836,144 in 1958, are anticipated to approximate to £1 million in 1959. Net tangible assets of the C. and B. group, excluding goodwill, trade marks, etc., amounted to £6,864,940 at 27 December 1958.

If the offer becomes unconditional (by 21 January) Fisons intend that the C. and B. business will continue as a separate entity under its own board. The only change contemplated is two additional directors nominated by Fisons.

Solartron Electronics

The agreement to acquire a 53.125% interest in the Solartron Electronic Group, Ltd., Thames Ditton, Surrey, by Firth Cleveland Ltd., Stornaway House, Cleveland Row, London S.W.1, will provide £900,000 immediately to ensure the adequate financing of Solartron's next five-year period of development and expansion. In becoming a subsidiary of Firth Cleveland Ltd., Solartron will continue in their independent progressive spirit.

Mr. Charles W. Hayward, chairman, and Mr. Gordon Harries, A.C.A., secretary of Firth Cleveland, will join the Solartron board, Mr. Hayward becoming chairman. Mr. John E. Bolton will be deputy chairman and managing director.

As a first step to the new arrangements, a meeting of Solartron is being convened on 14 January to increase the company's issued capital to £600,000 by the creation of 300,000 new ordinary shares of 10s. each, to be subscribed by Firth Cleveland at £3 each.

Allied Chemical Corporation

The Allied Chemical Corporation, U.S. manufacturers of chrome-based chemicals, have purchased the chrome producing company Montrose Exploration Co. Ltd., a concern whose shares are noted on the London Stock Exchange and which possesses large tracts of chrome ore-bearing land in the Transvaal.

Atlanticfonds

A new industrial share fund was recently opened by the Frankfurt-on-Main concern of Europa und Übersee Kapitalanlagegesellschaft m.b.H. under the name of Atlanticfonds. Some 50 leading industrial concerns including many chemical companies from the Continent, the British Commonwealth and North America; among them are the 'Big Three' German chemical producers, Badische Anilin- und Soda-Fabrik AG, Farbenfabriken Bayer AG, and Farbwerke Hoechst AG. Sales in the first instance have been made in blocks of one, 10 or 100 at national equivalents of $10 U.S.

Nord-West Oelleitung GmbH

Nord-West Oelleitung GmbH, the German pipeline company who now operate the longest crude oil pipeline in Europe serving both oil refining and petrochemical industries, have issued a report for the period 1956-58, in which a trading loss for last year of DM.12.5 million (£1,040,000) is reported. Construction costs for the loading facilities at the line's port terminus at Wilhelmshaven are given as DM.70 million (£5,834,000) and for the pipeline's first 245 miles to six refineries some DM.160 million (about £13,340,000). By next year two further plants are to be served by the line. Present pumping capacity of ten million tonnes annually is to be raised in the future to 22 million tonnes.

Wasag-Chemie AG

In the first 11 months of the year turnover of Wasag-Chemie AG and its subsidiaries lay at DM.179 million, or about £15 million, 20% above the level for the previous year's January-November period. Despite this overall rise no increase in production over 1958 took place in explosive chemicals and explosive equipment, mainly due to the bad state of the coal mining industry. Overall exports rose well and are expected to increase further in the future. Of the Wasag subsidiaries, two plastics companies showed particularly good years, the turnover of Rheinische Gummi- und Zelluloidfabrik standing at over 20% and that of the joint subsidiary Rhein-Plastic-Rohr GmbH nearly 50% above the 1958 level. Group developments include a new ammonium sulphate plant to reach full capacity working by the start of 1960 and a new powder unit for collodium wool to come into operation at about the same time at the Nitrochemie GmbH plant. Turnover of the group associate Guano-Werke AG—synthetic fertiliser producer—is 10% up on last year.

LONDON GAZETTE

Voluntary Winding-up

WESTORIA LTD., chemical and electrical engineers, registered office, 19 Woburn Place, London W.C.1. By special resolution, 30 October. Mr. J. J. Cook, Lambart Sladen and Co., 56 Buckingham Gate, London S.W.1, appointed liquidator.

AUGAS NORTHERN LTD., AUTOGENOUS GASES LTD., NEW-PROCESS GASES LTD., suppliers of industrial gases, regd. offices: 50 Gresham Street, London E.C.2. By special resolution, 17 November. Mr. E. W. Young, 50 Gresham Street, E.C.2, appointed liquidator.

INCREASE OF CAPITAL

ANGLO-AMERICAN NITROGEN CO. LTD., Public Wharf, Belgrave Gate, Leicester. Increased by £22,000 beyond the registered capital of £25,000.

NEW COMPANIES

A. M. B. PRODUCTS LTD. Capital £2,400. Manufacturers of and dealers in bleaching powders, preparations and materials, scouring powders and materials, cleansing materials, etc. Directors: A. M. Bullock and L. Bullock. Reg. office: Brewery Yard, Mexborough, Yorks.

CERACO (LANCS) LTD. Cap. £900. Manufacturers and merchants of chemicals for use in the manufacture of rubber, papers, paint, textile, food, metal, plastics, etc. Directors: L. Stoger and J. Waldie. Reg. office: 120 St. Anns Road, Prestwich, Manchester.

R. H. FOX AND SON (CHEMICAL ENGINEERS) LTD. Cap. £7,500. Directors: H. Fox, W. Burton and B. Cochran. Reg. office: Trading Estate, Billericay, Essex.

K. S. CHEMICAL SUPPLIES LTD. Cap. £100. To import, export, manufacture and compound chemicals, gases and disinfectants, etc. Reg. office: 16 The Green, Richmond, Surrey.

LINDSEY AGRICULTURAL TRADERS CO. LTD. Cap. £1,000. To manufacture and deal in chemical and other manures and fertilisers. Directors: Joyce E. A. Chard, E. J. Chard and Mrs. J. E. Chard. Reg. office: 1 New Street, Retford, Notts.

DUPHAR LTD. Capital £100,000. To carry on the business of manufacturers, buyers, sellers, importers and exporters of and agents for all kinds of pharmaceutical and biochemical products, fine chemicals, drugs, medicines, atomic and radioactive isotopes, chemicals, etc. Sub-

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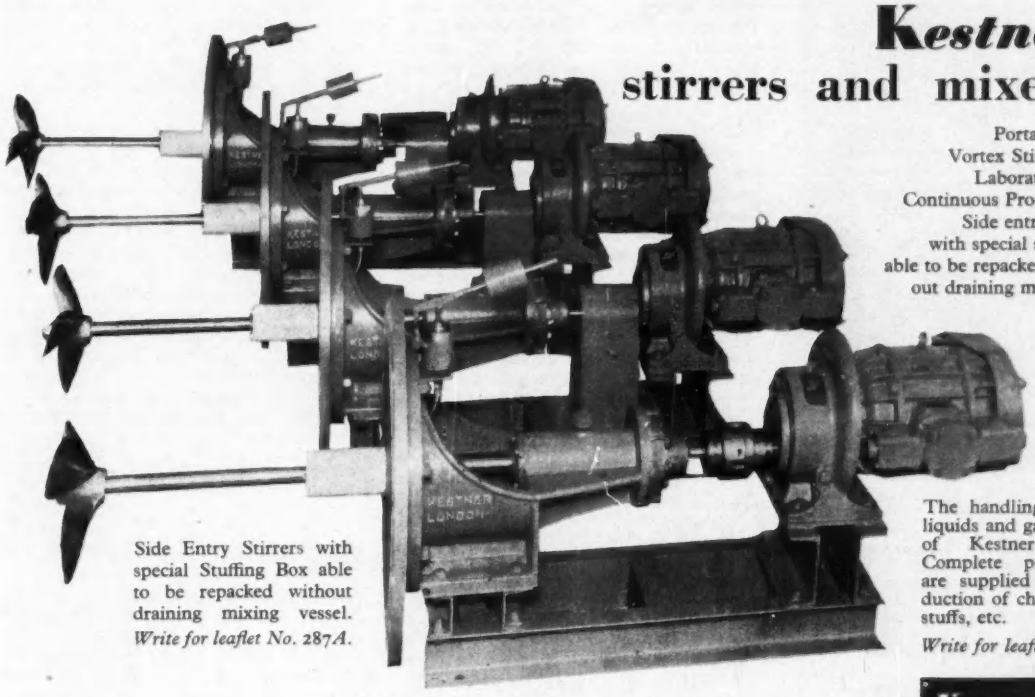

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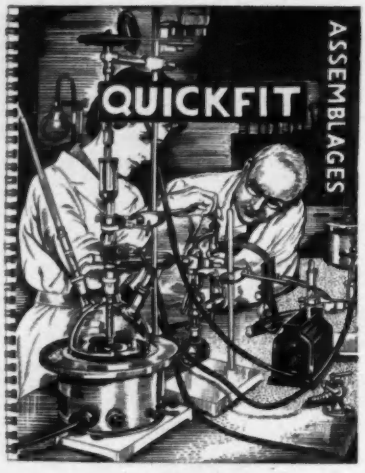

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LUWA (U.K.) LTD. Cap. £10,000. To manufacture, import, export and deal in equipment for processing of commodities of all kinds, including chemicals, synthetic resins, etc. Solicitors: Coward Chance and Co., St. Swithins House, London E.C.4.

MARK LABORATORIES LTD. Capital £2,500. To carry on the business of experimental and consulting chemists, physicists, engineers and metallurgists, etc. Subscribers: Richard M. Lucas, M. E. Baker. Directors to be appointed by subscribers. Solicitors: Gouldens, 40/43 Chancery Lane, London W.C.2.

RYE SOLVENTS LTD. Cap. £10,000. To distil solvents, manufacture and deal in and refine waste spirits, chemical and mineral substances and metals, etc. Directors: C. H. Worringham, P. J. Bate, A. J. Cole. Solicitors: Kingsley Wood and Co., 6/7 Queen Street, London E.C.4.

SCIENTIFIC AND INDUSTRIAL DEVELOPMENTS LTD. Cap. £1,000. To investigate, institute, operate and utilise new or improved manufacturing processes and products in the chemical metallurgical and engineering trades, etc. Directors: H. E. Ascoli, L. E. Winterbottom. Solicitors: Cripps, Harries Hall and Co., 1 New Square, London W.C.2. Reg. office: 5 St. James's Place, London S.W.1.

ROBERT WOMERSLEY AND SON LTD. Cap. £35,000. To acquire the business of Robert Womersley and Son, carried on by Leonard D. Womersley at 8 Chicksand Street, Whitechapel, London E, to distribute and manufacture all types of chemicals, etc.

Market Reports

INDUSTRIAL CHEMICALS ACTIVE AGAIN

LONDON Active trading conditions have returned to the industrial chemical markets with new business, both for spot and later delivery, covering satisfactory volumes.

Price movements have been fewer than is usual for the period and the undertone in most sections of the market is firm, though a number of plasticisers have been reduced in price. Basic slag continues in strong demand on the fertiliser market but buying interest in other materials remains slow.

Among the coal tar products naphthalene supplies are tight but otherwise the market is without feature. Dearer quotations have been reported for refined grades of cresylic acid.

MANCHESTER The Manchester market for heavy chemical products has opened the year on a cheerful note, although fresh buying interest has not yet got fully into stride again after the holiday dullness. There has, however, been a satisfactory movement of supplies against contract bookings with home consumers, who are mostly well covered over the next few months. The shipping movement has also been resumed reasonably well and traders are hopeful that export business in chemicals will at least be maintained at 1959's improved level. In the fertiliser section the usual seasonal spurt in a number of lines that have been relatively quiet of late is anticipated during the next week or two.

SCOTLAND Trading has been reasonably brisk with a slight falling off due to the New Year holidays. Quite an interest has been centred around contract requirements for 1960 with a good volume of business applicable to forward current requirements after the holiday period. The price position has remained fairly steady.

In regard to the overseas market quite a volume of inquirements have been received and a reasonable level of business was maintained.

Laboratory Design Advisory Service

A SERVICE "which bridges the gap between the man at the laboratory bench —and the variety of separate organisations who can interpret and provide the necessary facilities" has been set up by Scientific Installations Ltd., 1 Salisbury Square, London E.C.4.

Said to have been used already by a number of well-known companies, the service is intended to eliminate costly and time-wasting duplication in design and selection of equipment, and is fully described in a booklet 'Have you a planning problem?' available from the firm.

Shorter Hours and Better Pay

Introduction of the 42-hour week is announced by Pfizer Ltd., of Folkestone, Kent. The company is also making increases in salary of weekly staff.

Safety News by Card Index from R.S.P.A.

DISTRIBUTION of information on the subject of safety in industry will be facilitated early next year by a big new scheme sponsored by the International Labour Office, and carried through in the U.K. by the Royal Society for Prevention of Accidents.

In the scheme, index cards will be used carrying information from countries throughout the world, and they will be available, in complete sets only, from the national organising centre in each country.

The Association of British Chemical Manufacturers and the Chemical Society are among the organisations which have agreed to collaborate. Cost to U.K. subscribers will be £14 5s a year, and enquiries should be addressed to the R.S.P.A., 52 Grosvenor Gardens, London S.W.1.

DIARY DATES

MONDAY 11 JANUARY

Inst. Rubber Ind.—Manchester: Newton Heath Technical College, 6 p.m. 'White reinforcing fillers', by J. D. Harris.

Plastics Inst. with Inst. Rubber Indys.—Birmingham: James Watt Memorial Inst., Gt. Charles St., 6.30 p.m. 'Some recent developments in plastics and rubber machinery', by K. Wilson.

S.C.I.—London: 14 Belgrave Sq., S.W.1, 5.30 p.m. 'Emulsions in theory and practice', by Dr. G. C. Sumner.

TUESDAY 12 JANUARY

Bradford C.S.—Bradford: Inst. of Technology, 7 p.m. 'Biology in industry', by Dr. D. S. Belford.

O.C.C.A. with Inst. Rubber Indy.—London: Manson Hse., 26 Portland Pl., W.1, 7 p.m. 'Hypalon in surface coatings'.

R.I.C.—Gravesend: Mayfield Hall Annexe, Technical College, Pelham Rd., 7 p.m. 'Use of oxygen in the iron and steel industry', by J. A. Charles.

S.A.C.—Birmingham: Mason Theatre, The University, Edmund St., 6.30 p.m. 'Micro gas analysis', by G. J. Minkoff.

S.C.I.—London: 14 Belgrave Sq., S.W.1, 6 p.m. 'Critical examination and joint technological approach to project work in the chemical industry', by H. Birchall and D. S. Binsted.

WEDNESDAY 13 JANUARY

Plastics Inst. with Inst. Rubber Ind.—Southampton, Polygon Hotel, 7.30 p.m. 'Recent developments in rubber and plastics machinery', by K. M. Wilson.

S.C.I.—London: 14 Belgrave Sq., S.W.1, 6 p.m. 'Corrosion problems of high temperature pressurised water reactors', by J. N. Wanklyn.

S.C.I. with Soc. for App. Bacteriology—London: Royal Soc. of Medicine, 1 Wimpole St., W.1, 2.15 p.m. 'Methods for evaluation of antibacterial activity of surface active compounds'.

THURSDAY 14 JANUARY

C.S.—London: Royal Institution, Albemarle St., W.1, 7.30 p.m. Tilden lecture, 'Progress in the study of heterogeneous catalysis', by Prof. C. Kemball.

C.S. with R.I.C. & S.C.I.—Bristol: Dept. of Chemistry, University, 6.30 p.m. 'Dyeing of the newer synthetic fibres', by J. G. Graham.

Inst. Plant Eng.—Newcastle-upon-Tyne, Roadway Hse., Oxford St., 7 p.m. 'Pipeline cleaning techniques', by M. Webb.

FRIDAY 15 JANUARY

C.S.—Birmingham: Large Chemistry Lecture Theatre, University, 4.30 p.m. 'Alkali metal derivatives of organic and organometallic compounds', by Prof. G. E. Coates.

S.C.I.—London: 14 Belgrave Sq., S.W.1, 6.30 p.m. 'Recent developments in analgesics', by Dr. A. H. Beckett.

Inst. Physics—Newport: College of Technology, 6 p.m. 'Microstructure of crystalline solids', by Dr. J. W. Menter.

TRADE NOTES

Glassware Prices Down

An average price reduction of 10% in essential glassware for industry has been announced by James A. Jobling and Co. Ltd., Wear Glassworks, Sunderland.

Nucleonics Catalogue

Ekco Electronics Ltd., Southend-on-Sea, Essex, have published a new catalogue of their range of nucleonic instruments for use in medicine, industry, research and reactor instrumentation.

New Antirheumatic Agent

A new product, Electol, containing chloroquine phosphate, prednisone and aspirin, is being marketed by F.B.A. Pharmaceuticals Ltd., 37-41 Bedford Row, London W.C.1, as an antirheumatic agent.

Melamine Prices Down

A reduction in the price of melamine from British Oxygen Chemicals Ltd., Bridgewater House, Cleveland Row, London S.W.1, has been announced. (See also p. 73 for other price cuts.)

Change of Name

Foundry Chemicals Ltd., 285 Long Acre, Nechells, Birmingham 7, have changed their name to Kemwell Ltd.

High Duty Alloys

High Duty Alloys Ltd. have moved their Glasgow office to De Quincey House, 48 West Regent Street, Glasgow, C.2. (Douglas 1500.) Inquiries for forgings in Scotland and N. Ireland will still be dealt with by the Manchester office.

Anti-Corrosive Titanium

Titanium and its uses in corrosion resistance is described in a publication issued by the I.C.I. Metals Division and entitled Titanium-3.

Resistance of titanium to simple chemical reagents, to industrial liquors and to liquid metals, are tabulated; and a list of area sales offices is appended, at which further information may be obtained. The booklet is available from the Division's headquarters, P.O. Box 216, Birmingham 6.

Boby's Enter Australian Market

Acting initially through Elder Smith and Co. Ltd., Adelaide, and their continent-wide chain of agents and local offices, William Boby and Co. Ltd.'s water treatment plant and electrodialysis stacks will eventually be completely made in new factory-design units in every state in Australia. (See 'People,' p. 96.)

Laboratory Glassware

A price list for 1960 for 'Quickfit' interchangeable laboratory glassware is available from Quickfit and Quartz Ltd., Heart of Stone, Staffordshire.

Plastics Products

A series of colour-printed leaflets is available from BX Plastics Ltd., a subsidiary of the British Xylonite Co. Ltd., Higham Station Avenue, London E.4. These describe and illustrate the firm's transparent corrugated sheet ranges of thermoplastics materials, corrosion resistant materials and 'optical' sheet, etc.

Jones Mobile Cranes

A long lease has been arranged for one of the Board of Trade factories at Newburn-on-Tyne by K. and L. Steelfounders and Engineers Ltd., makers of Jones mobile cranes, to contend with increasing demand from both home and export markets. H.Q. of the firm, one of the Cohen Group, are at Letchworth, Herts.

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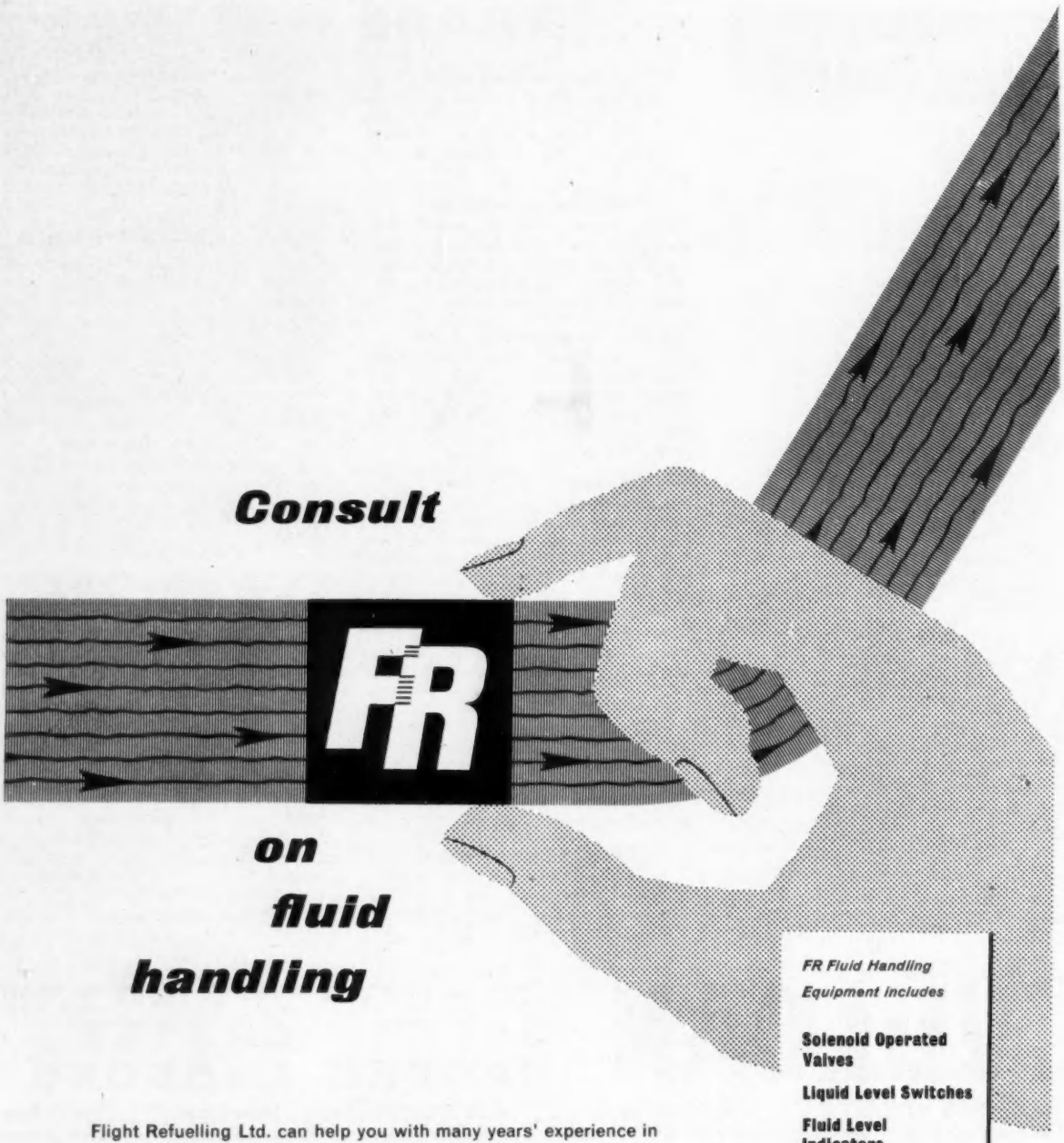

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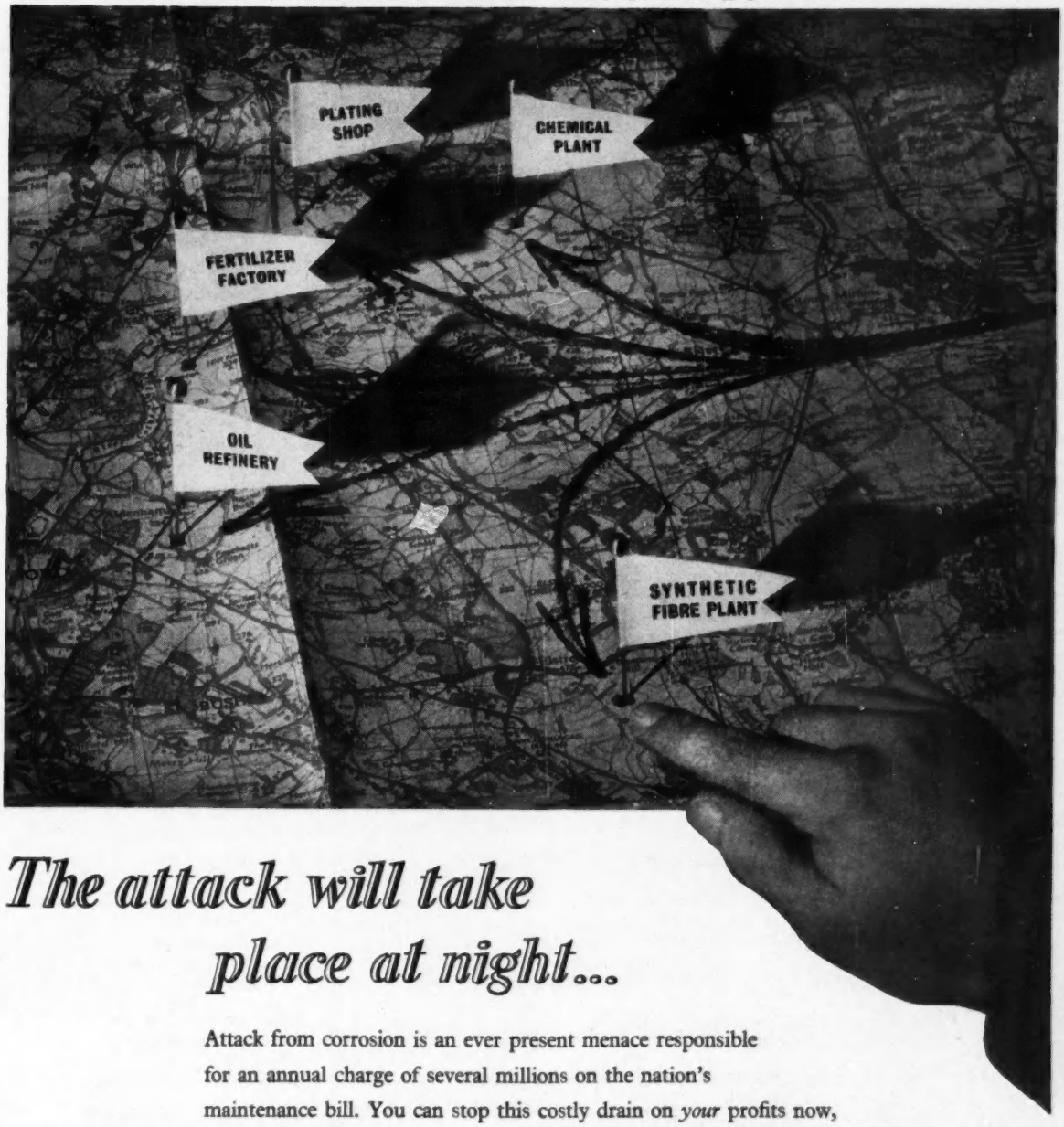

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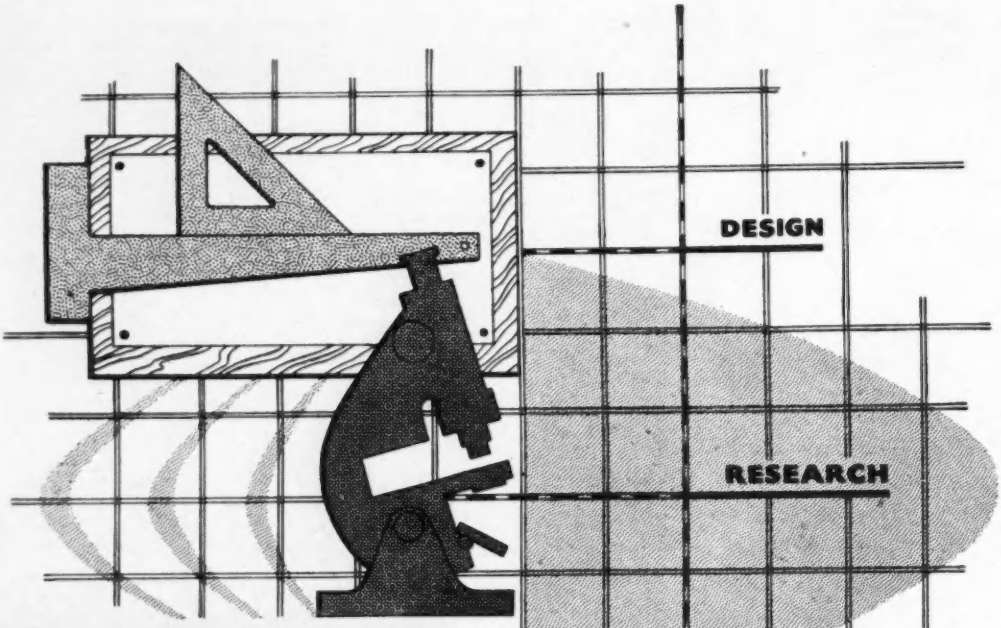

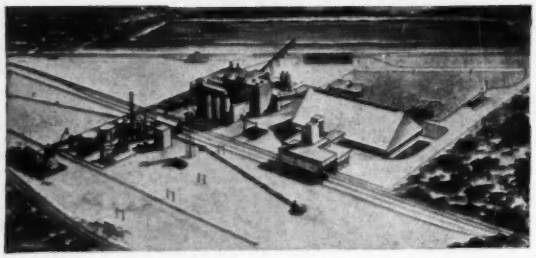

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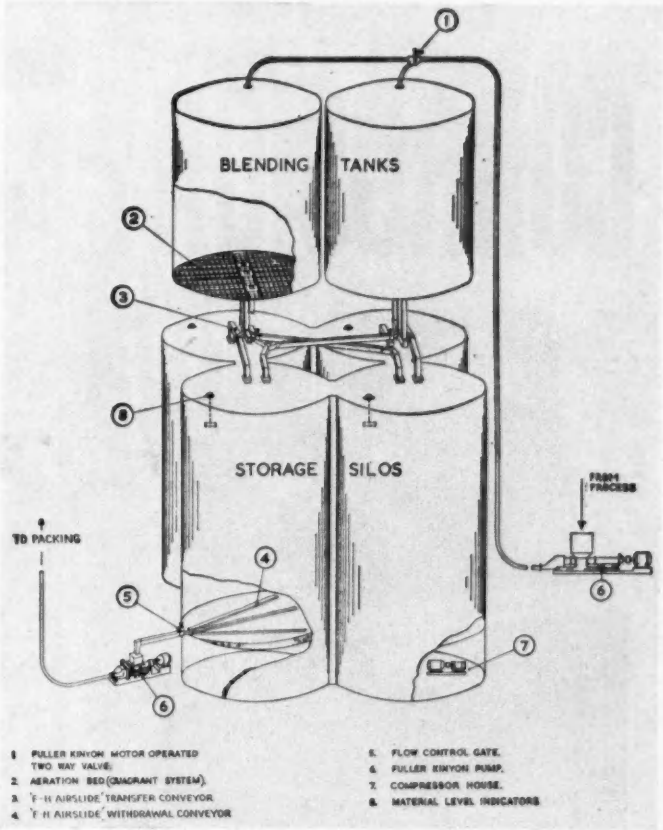

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CORROSION?

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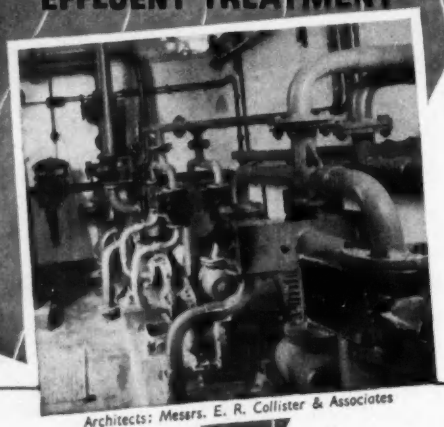

Architects: Messrs. E. R. Collister & Associates

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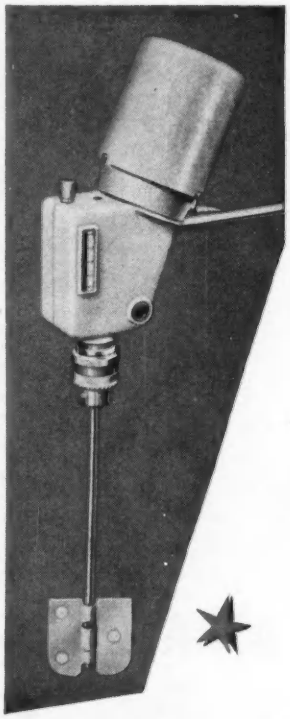

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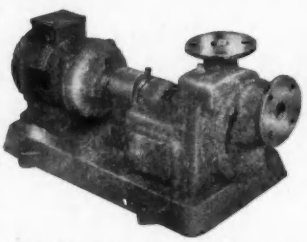

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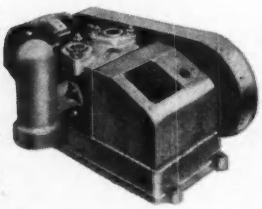

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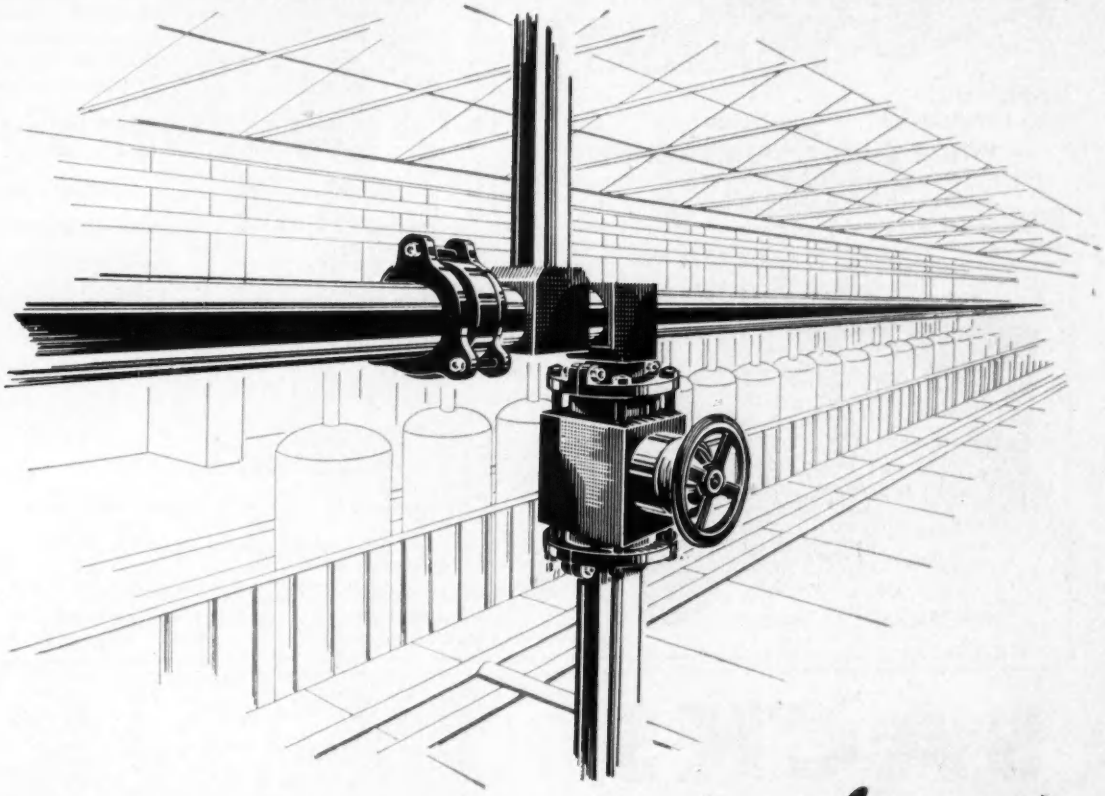

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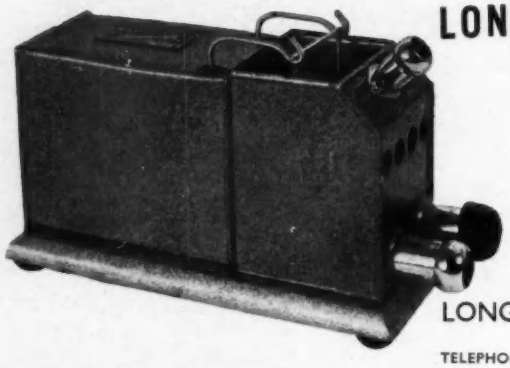

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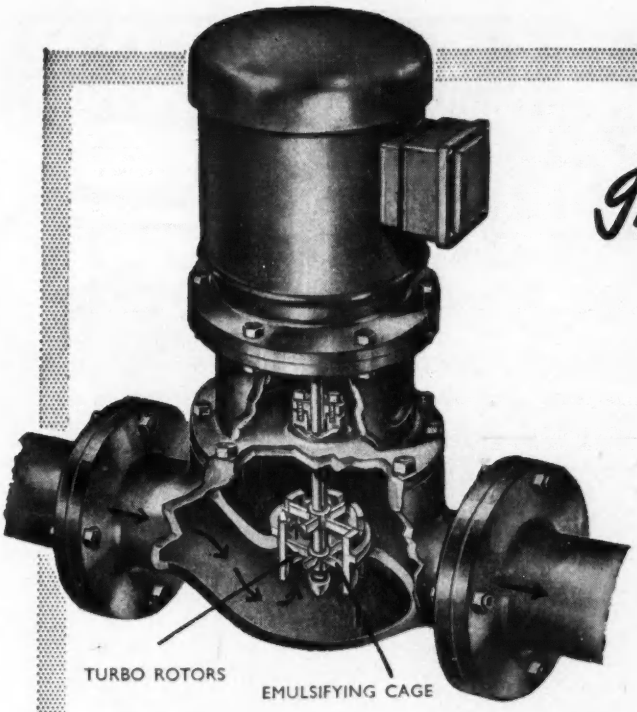

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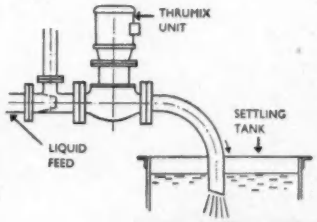

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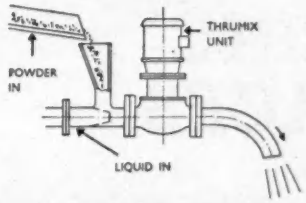

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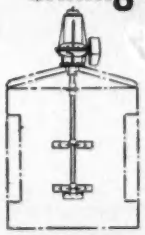

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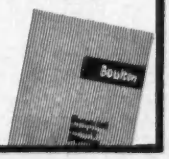

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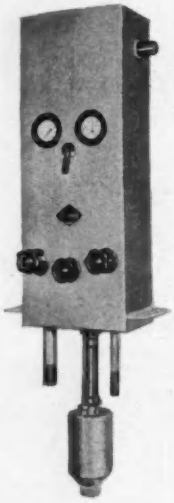

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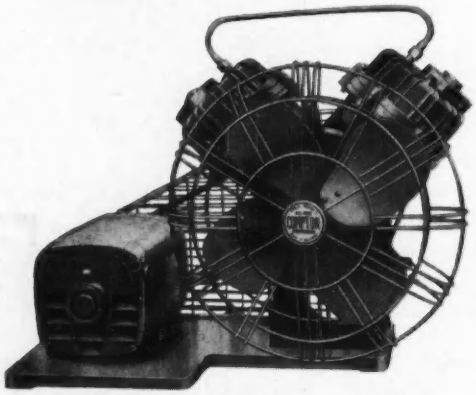

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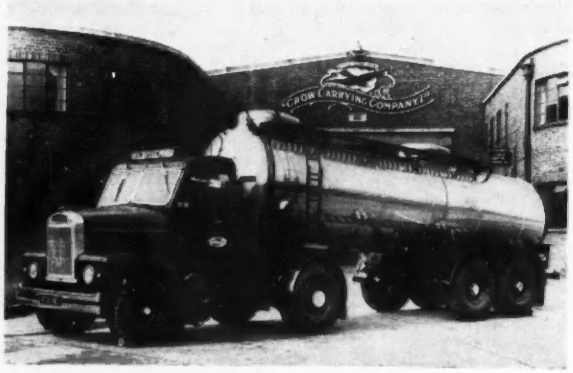

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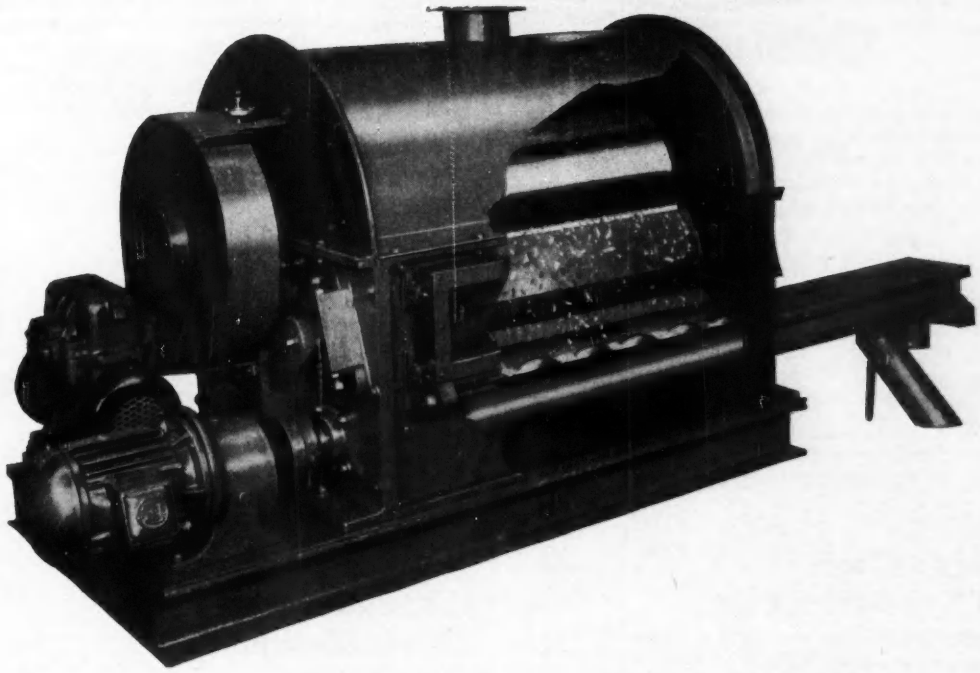

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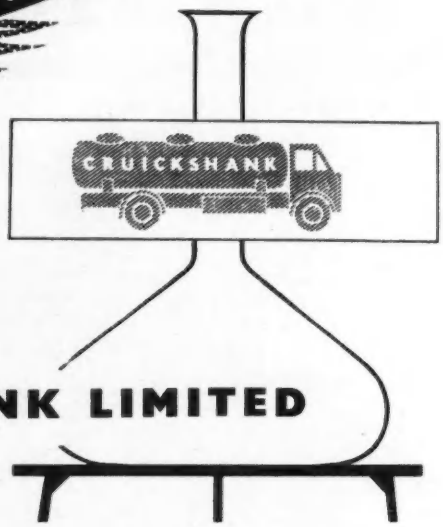

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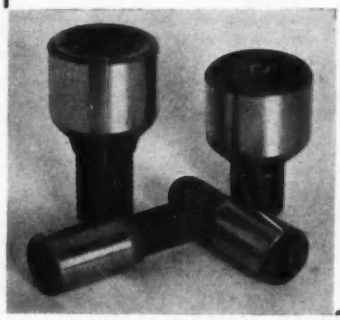

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CARBON DIOXIDE
KETONES
POLYSTYRENE
BUTADIENE
VITAMIN B12
PENICILLIN
XANTHOCILLIN

DCL

*D.C.L. CHEMICAL GROUP
D.C.L. Chemical Division
The Methylating Company Ltd
Orobis Ltd
Honeywill-Atlas Ltd
Hedon Chemicals Ltd
*D.C.L. PLASTICS GROUP
British Geon Ltd
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Distrene Ltd
D.C.L. BIOCHEMICAL GROUP
The Distillers Company (Biochemicals) Ltd
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